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Biological Assessment of Reclamation's Proposed Section 7(a)(1) Conservation Measures for Listed Species in the Imperial Irrigation District/ Salton Sea Areas

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Acronyms and Abbreviations

AAC	All-American Canal
af	acre-feet
AFEIS	Administrative Final Environmental Impact Statement
BA	Biological Assessment
BO	Biological Opinion
°C	degrees Celsius
California Plan	California's Colorado River Water Use Plan
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cm	centimeters
CRA	Colorado River Aqueduct
CVWD	Coachella Valley Water District
DDT	dichlorodiphenyl-trichloroethane
DW	dry weight
EIR/EIS	Environmental Impact Report / Environmental Impact Statement
°F	degrees Fahrenheit
FR	Federal Register
ESA	Endangered Species Act
g/L	grams per liter
Guidelines	Colorado River Interim Surplus Guidelines
HCP	Habitat Conservation Plan
IA	Implementation Agreement
IID	Imperial Irrigation District
IOP	Inadvertent Overrun and Payback Policy
KAFY	thousand acre-feet per year
LCR	lower Colorado River

LCR MSCP	Lower Colorado River Multi-Species Conservation Program
m	meter
msl	mean sea level
MAFY	million acre-feet per year
μg/L	micrograms per liter or parts per billion
mg/L	milligrams per liter or parts per million
MWD	Metropolitan Water District
NEPA	National Environmental Policy Act
ppm	parts per million
ppt	parts per thousand
QSA	Quantification Settlement Agreement
Reclamation	U.S. Bureau of Reclamation
SDCWA	San Diego County Water Authority
Secretary	Secretary of the Interior
Service	U.S. Fish and Wildlife Service
SSA	Salton Sea Authority
SWP	State Water Project
TDS	total dissolved solids
TSS	total suspended solids

CHAPTER 1

Introduction

This document constitutes a voluntary written request to initiate formal consultation pursuant to 50 C.F.R. 402.13(c)(1-6).[1]

The proposed federal action is implementation of a proposed species conservation plan. This conservation plan is a voluntary undertaking by Reclamation which is comprised of certain actions under Section 7(a)(1) of the ESA. In proposing to undertake these voluntary conservation actions, it is Reclamation's intent that the conservation plan could offset potential impacts to listed species from water conservation actions taken by IID pursuant to the transfer.

The California Colorado River Water Use Plan (Plan) is designed to reduce California's use of Colorado River water to its basic apportionment of 4.4 million acre-feet per year (MAFY). The Plan is comprised of certain state actions, a number of which are outlined and included in the Quantification Settlement Agreement (QSA). The Plan includes the conservation and transfer (transfer) of up to 300 thousand acre-feet (KAF) of Colorado River water from the Imperial Irrigation District (IID) to the San Diego County Water Authority (SDCWA), Coachella Valley Water District (CVWD) and/or Metropolitan Water District (MWD).

Reclamation completed its Section 7 analysis in January 2001 for the federal Implementation Agreement (IA). Developing and approving an HCP under Section 10 of the ESA for impacts to listed species in the Salton Sea from actions undertaken by IID for the transfer has been a challenging and time consuming process. Concerns have arisen that either the HCP will not be completed prior to December 31, 2002[2], or that the parties to the transfer will not agree to implement the conditions of the HCP. In light of this concern, Reclamation is undertaking a voluntary Section 7 analysis as an alternative means of providing incidental take authorization for non-federal parties to address the potential impacts of IID's water conservation on currently listed species.

As discussed below, Reclamation anticipates that it would enter into conservation agreements with various California agencies with authorization to undertake conservation measures for coordinated actions and funding for these proposed conservation actions and/or other conservation actions identified and developed by the California agencies.

Implementation and administration of these measures would continue for the life of the QSA (75 years) or up to the time a habitat conservation plan (HCP), developed by IID, has been approved by the U. S. Fish and Wildlife Service (Service). If the IID HCP is approved, or if a Salton Sea restoration project is authorized and funded, it is anticipated that the conservation measures may be terminated or integrated with the restoration project. If the

[1] The preparation of this document is not required pursuant to provision of 50C.F.R.402.12(b), which provides that preparation of a biological assessment, as the term is defined in 50C.F.R.402.02, is required for "major construction activities". Reclamation does not believe that any of the proposed conservation measures meet this definitional requirement.

[2] This date is relevant to Section 5 of the Interim Surplus Guidelines (Guidelines).

QSA is not implemented, Reclamation may choose to not undertake the proposed conservation actions.

In conjunction with the description of the conservation plan, this biological assessment (BA) will also analyze the impacts to listed species from water conservation actions undertaken by IID pursuant to the QSA. These actions will be analyzed in this BA as a cumulative effect because the implementation of these actions do not involve federal activities and they are reasonably certain to occur within the Salton Sea area. 43 CFR 402.02. Reclamation believes this is the most appropriate characterization of these potential impacts in light of all circumstances as of the date of this biological assessment (see Chapter 4). Because it is possible that take of listed species might occur as a result of the water conservation actions taken by IID, Reclamation anticipates the Service would issue an incidental take statement to provide coverage for these private actions in the context of anticipated species conservation agreements with the California agencies (see discussion in Chapter 1.4).

This chapter discusses the current status of all ESA actions undertaken by all the parties, and describes the voluntary conservation plan proposed by Reclamation pursuant to Section 7(a)(1) of the ESA.

1.1 Background

As discussed above, the California water agencies have worked vigorously in recent years to develop and implement provisions of the California Plan. The California Plan would enable California to reduce its diversions of Colorado River water in normal years to its 4.4 MAFY apportionment under applicable federal law. A significant component of the draft California Plan is IID's proposed conservation and transfer of up to 300 KAFY of Colorado River water to SDCWA, CVWD and/or MWD. The IID Water Conservation and Transfer Project is envisioned to occur within the context of an executed QSA among CVWD, IID, and MWD.

Completion of HCP for the IID Water Conservation and Transfer Project is uncertain. In order to address potential impacts of IID's non-federal action in the Salton Sea area in the event that the HCP cannot be completed by the QSA deadline, Reclamation is undertaking this voluntary consultation under Section 7 of the ESA, in part, to potentially provide the non-federal parties an alternative approach to incidental take coverage for the actions of non-federal parties associated with the Transfer Project.

1.1.1 Consultation History

Previous consultations on the actions related to the California Plan include the following:

- <u>Guidelines and IA</u> Reclamation's proposed change in operation in the Colorado River between Parker and Imperial Dams, including implementation of the Guidelines and the change in the point of diversion required for the water transfer projects and the All American Canal (AAC) and Coachella Canal lining projects consistent with provisions of the QSA, is a federal action that has been addressed through a prior Section 7 consultation. Reclamation submitted a BA to the Service on August 30, 2000 (*Biological Assessment for Proposed Interim Surplus Criteria, Secretarial Implementation Agreements for California Water Plan Components and Conservation Measures on the Lower Colorado River (Lake Mead to the Southerly International Boundary)*. The Service issued a biological opinion LCR BA

(BO) for the Guidelines on January 12, 2001 (Service, 2001), that provides incidental take authorization for federally listed species potentially affected by the Guidelines and the proposed IA. Both the 2000 BA and 2001 BO contain substantial information on the species considered in this BA, and that information is incorporated by reference herein. LCL BO

A complete list of previous Section 7 consultations related to the LCR is in the Description and Assessment of Operations, Maintenance, and Sensitive Species of the Lower Colorado River, Biological Assessment (USBR, 1996).

- AAC Lining Project ESA compliance was completed for the project in 1994. Reclamation reviewed the documentation in 1999 and determined it to still be adequate. The project would replace 23 miles of unlined canal with lined canal in order to conserve a portion of the water being lost through seepage from the existing canal. The project has been approved, but has not yet been constructed.
- Coachella Canal Lining Project ESA compliance was completed in March 2002, with a letter from the Service which concurred with Reclamation's finding of "may affect, not likely to adversely affect" for six federally listed species. The purpose of the project is to conserve water being lost to seepage from unlined portions of the canal.

Future federal projects will require separate compliance under the ESA. The following federal projects are located on the Colorado River or at the Salton Sea and will be subject to Section 7 compliance:

- Proposed LCR Multi-Species Conservation Program (MSCP) The LCR MSCP is intended to provide long-term ESA and California Endangered Species Act (CESA) compliance and incidental take authorization for a number of actions affecting the LCR. A Draft EIS/EIR, BA, and HCP are being prepared to analyze the impacts of the LCR MSCP. Reclamation and the Service are the lead agencies under the National Environmental Policy Act (NEPA), and MWD is the lead agency under the California Environmental Quality Act (CEQA). Conservation measures would focus on the LCR from Lake Mead downstream to the international boundary. The comprehensive program is planned to be implemented over a 50-year period. It will address future federal agency consultation needs under Section 7 of the ESA and non-federal agency needs for approval of incidental take authorization for endangered species under ESA Section 10.
- Salton Sea Restoration Project The Salton Sea Restoration Project is evaluating actions to stabilize the elevation and reduce the salinity of the Salton Sea, pursuant to the Salton Sea Reclamation Act of 1998 [Public Law (PL) 105-372]. The Salton Sea Authority (SSA), as the California lead agency under CEQA, and Reclamation, as the federal lead agency under NEPA, released a Draft EIS/EIR in January 2000 that evaluated proposed Salton Sea Restoration Project alternatives (Reclamation and SSA, 2000). A Draft Alternatives Report, including different alternatives and revised modeling and impact analysis, is currently being prepared. ESA compliance will be required for implementation of any of the alternatives.

1.1.2 Salton Sea

The present-day Salton Sea was formed in late 1905 by a break in a temporary levee along the Colorado River. For a period of about 16 months after the breach in the levee, Colorado River water flowed into the Salton Sink, a below sea-level depression, and formed what is now referred to as the Salton Sea. The two primary sources of inflow into the Salton Sea are from either agricultural return flows from water users within the U.S. or from flows in the Alamo and New Rivers from Mexicali, Mexico (which include return flows from Mexican irrigation use). The controlling legal authorities under which the Secretary operates the River, including the Supreme Court Decree in *Arizona v. California* and the Boulder Canyon Project Act, do not authorize the Secretary to deliver Colorado water directly to the Salton Sea.

1.2 Reclamation Authorities

As confirmed by the Supreme Court decree in *Arizona v. California*, irrigation interests within the state of California have the right to use Colorado River water under both state and federal law. The Secretary, acting through the Bureau of Reclamation, operates the facilities on the Colorado River in accordance with the applicable provisions and limitations imposed by federal law. In particular, Article II of the decree states that the Secretary is enjoined from releasing water from Hoover Dam except as provided in the decree. The Supreme Court retains jurisdiction of the matters addressed in the *Arizona v. California* "for the purpose of any order, direction, or modification of the decree…"

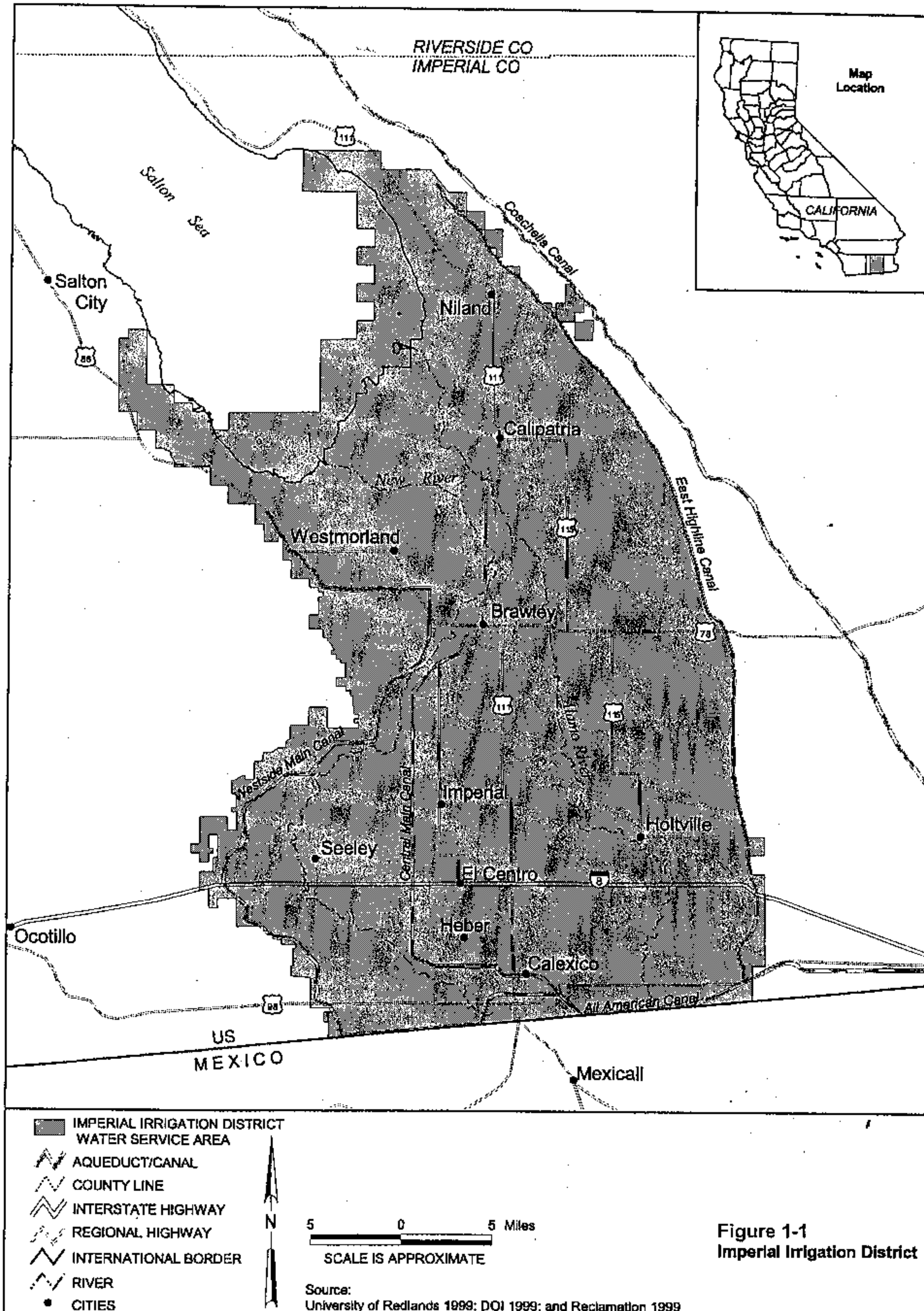
1.3 Area Covered by the Biological Assessment

This BA includes lands comprising the approximately 500,000 acres of IID's service area in Imperial County, California, the Salton Sea, and lands owned by IID outside of its service area that are currently submerged by the Salton Sea. This area is illustrated on Figures 1-1 (IID Service Area) and 1-2 (Salton Sea).

1.4 Description of Proposed Action

1.4.1 IID/Salton Sea Areas Species Conservation Plan

The Proposed Action is implementation of a voluntary species conservation plan in conjunction with non-federal parties designed to conserve listed species found in the area of the Salton Sea (including adjacent areas in Coachella and Imperial Valleys). The proposed action is designed, in part, to avoid, minimize, and mitigate impacts of IID's water conservation actions on federally listed species. Reclamation proposes to implement the species conservation plan measures, either separately or cooperatively with some or all of the QSA beneficiaries (IID, CVWD, MWD, SDCWA) in the State of California as partners. It is anticipated that specific conservation agreements for implementation of conservation measures will be executed with willing partners during the consultation period prior to issuance of any BO. Both habitat-based and species-specific conservation measures are proposed. Habitat-based measures are designed to mitigate the potential loss of habitat values (quantity and quality) with an overall objective of maintaining or increasing, where possible, the value (amount and/or quality) of each habitat used by federally listed species covered in the Conservation Plan (e.g., drain, tamarisk scrub, and Salton Sea habitats).



Source:
University of Redlands 1999; DOI 1999; and Reclamation 1999

Figure 1-1
Imperial Irrigation District

CH2M Hill RDD ArcView Project File \\rddgis\iid\regional_maps_b.apr APE_fig1.pdf 4:43 p.m. 06-18-2002

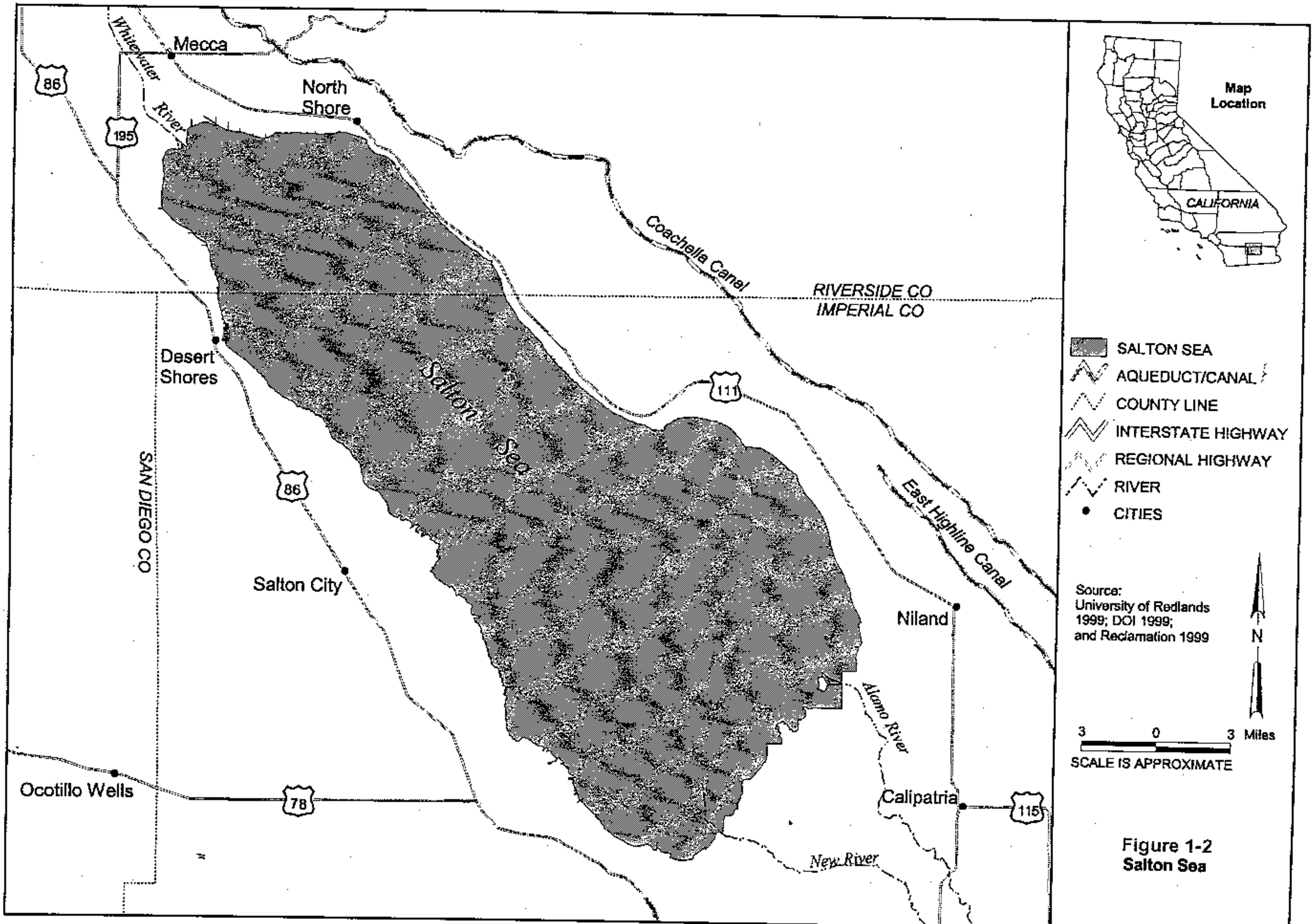


Figure 1-2
Salton Sea

CH2M Hill RDD ArcView Project File \\rddgis\iid\regional_maps_b.apr APE_fig2.pdf 4:45 p.m. 08-18-2002

1.4.2 Desert Pupfish (*Cyprinodon macularius*)

Various surveys conducted by the California Department of Fish and Game (CDFG) and others have recorded the presence of desert pupfish in many of IID's drains that discharge directly to the Salton Sea (Sutton, 1999). Although IID routinely maintains adequate drainage in these channels by removing vegetation and sediment, these drains provide the habitat conditions (e.g., water quality, food source, and aquatic vegetation) necessary to support pupfish. Implementation of water conservation projects by IID has the potential to change water quality in the drains occupied by pupfish that could adversely affect them. Potential impacts of IID's water conservation measures on desert pupfish are presented in Chapter 4.

The intent of the desert pupfish conservation measures is to maintain viable populations in the project area by maintaining or increasing pupfish habitat in IID's drains relative to current levels (i.e., no net loss) and maintaining connectivity among drain populations.

- Minimize the impacts of potential increases in salinity concentrations on pupfish habitat connectivity among drains (Pupfish Conservation Measure 1)
- Minimize the impacts of potential increases in selenium concentrations and possible other contaminants in the drainage system resulting from water quality changes (Pupfish Conservation Measure 2)

Pupfish Conservation Measure 1: Connectivity Impacts

In cooperation with its conservation-agreement partners, Reclamation will ensure that an appropriate level of connectivity is maintained between pupfish populations in individual drains (at the north and south ends of the sea) connected to the Salton Sea either directly or indirectly and that drain habitat below the first check will be maintained in the event that conditions in the Salton Sea become unsuitable for pupfish. Reclamation will undertake planning and studies so that before the salinity of the Salton Sea reaches 90 parts per thousand (ppt), the parties can implement a detailed plan for ensuring genetic interchange among the pupfish populations in the drains.

In cooperation with its conservation-agreement partners, Reclamation will maintain the amount of potential pupfish drain habitat (expressed as linear channel distance) over the term of IID's water conservation and transfer project. This will be accomplished as the Sea recedes by extending or modifying existing IID drains or by maintaining the suitability of naturally created drain channels. The design, configuration, and management of these areas will be developed jointly with Reclamation and Service staff, and will be developed in consideration of the specific physical characteristics of pupfish habitat (e.g., water depth and velocity, and channel width) and water quality (e.g., turbidity and selenium concentration).

Pupfish Conservation Measure 2: Selenium Impacts

Reclamation will work in cooperation with IID to ensure that IID operates and maintains its drain channels in a manner that minimizes impacts of water conservation on water quality. Reclamation will monitor selenium concentrations in pupfish drains and commit to funding studies to determine the impacts of selenium on pupfish. Reclamation will then work with IID and the Service to determine within 2 years of completion of FWS studies the best means for managing IID's drain channels to minimize potential selenium impacts on pupfish. If the studies are not completed within 10 years, Reclamation and IID will use best-available scientific information to determine the best means for managing the drain channels to minimize potential selenium impacts on pupfish. Measures to be considered may include splitting combined drain channels (drain/operational water) to improve water quality, providing limited biological treatment, including use of discharge from managed marsh mitigation habitat, and consolidating channels and blending flows.

Pupfish Conservation Measure 3: Management and Monitoring

In cooperation with its conservation-agreement partners, Reclamation will contribute funds for routine monitoring of pupfish presence to confirm continued presence in the drains and to develop information useful in adjusting management actions for this species. In cooperation with FWS, Reclamation will develop a survey protocol that is appropriate for determining pupfish presence in the drains. This protocol will be used to develop baseline information on presence and patterns of activity by pupfish in drains and to determine the effectiveness of any adjustments in drain management and habitat enhancement measures.

1.4.3 Yuma Clapper Rail (*Rallus longirostris yumanensis*)

In the project area, Yuma Clapper Rail predominantly occurs on state and federal refuges. Agricultural drains support limited use by clapper rails. Breeding is not verified in the drains, but rail presence is documented in surveys of drains during the breeding season. The IID drainage system is estimated to contain about 63 acres of cattails. Common reed, tamarisk, and arrowhead are the predominant species of the remaining 589 acres of vegetation in the drainage system. Potential project impacts on clapper rails consist of loss and degradation of cattail vegetation in drains through increased salinity and exposure to increased selenium concentrations in drains.

The acreage of cattails supported in the drains could potentially be reduced by 4 acres due to increased salinity, and an additional 23 acres of remaining cattail vegetation could be subjected to increased salinity levels that could stunt growth and reduce vigor of the plant. If fallowing is used to conserve water, there would be no change in salinity in drains and, therefore, no impacts to cattail vegetation. Under current conditions, average impairment in Yuma Clapper Rail egg hatchability due to selenium levels is 3 percent. As a result of IID's water conservation actions, hatchability could be impaired up to 6 percent, comprising a 3 percent increase above the current condition. Use of fallowing as a water conservation method would reduce the level of impairment due to increased selenium concentrations in the drains.

Clapper Rail Conservation Measure 1: Salinity Impacts

Thirty-one acres of high quality managed marsh will be created to mitigate for potential salinity impacts (2:1 mitigation for 4 acres lost, and 1:1 mitigation for the additional 23 acres of reduced quality habitat). In cooperation with its conservation-agreement partners, Reclamation will work with FWS to determine the design and location of these marshes.

Clapper Rail Conservation Measure 2: Selenium Impacts

Up to 21 acres of additional high quality managed marsh habitat will be created to offset the impacts of potential selenium impacts on clapper rail egg hatchability. If feasible, this marsh habitat will be located adjacent to the managed marsh habitat discussed in Clapper Rail Conservation Measure 1. The 31 acres of mitigation listed above for salinity impacts will also contribute to reducing the impacts of potential selenium impacts on clapper rail egg hatchability. The created habitat will be monitored for selenium and salinity. The total amount of 52 acres of habitat will be created within 15 years of completion of this consultation.

Clapper Rail Conservation Measure 3: Management and Monitoring

A long-term management plan will be developed for the mitigation marsh and submitted to the Service for review and approval prior to initiation of habitat creation activities. An acceptable monitoring plan for the mitigation marshes, which specifies performance criteria for vegetation growth and the frequency and techniques used in monitoring will be developed.

1.4.4 Southwestern Willow Flycatcher (*Empidonax traillii brewsteri*)

Although Southwestern Willow Flycatchers have been observed in low numbers during migration season, no breeding has been documented within the project area. Willow flycatchers have been reported using tamarisk and common reed along the Salton Sea and agricultural drains, and in seepage communities adjacent to the East Highline Canal during migration. In other areas within its range, Southwestern Willow Flycatcher has been documented using tamarisk stands for breeding, if these stands contain areas of saturated soils or standing water. Water conservation measures undertaken by IID have the potential to impact tamarisk stands within the project area. However, it is unknown if any of these stands have the necessary components to be considered suitable Southwestern Willow Flycatcher breeding habitat at this time.

Willow Flycatcher Conservation Measure 1-Evaluate Habitat

All potential cottonwood-willow and tamarisk stands will be evaluated for Southwestern Willow Flycatcher breeding habitat suitability. Using the Anderson and Ohmart classification system (1994), each Saltcedar III and IV and each Cottonwood-willow I, II, III, and IV stand will be evaluated for suitability based on density, structure, and presence of standing water or saturated soils during the breeding season.

Willow Flycatcher Conservation Measure 2-Surveys and Nest Monitoring

Once Willow Flycatcher Conservation Measure 1 has been completed, all stands considered suitable for Southwestern Willow Flycatcher breeding will be surveyed during the breeding season. Any nesting attempts will be documented and all nests found will be monitored for nest success.

Willow Flycatcher Conservation Measure 3-Suitable Habitat Monitoring

If suitable Southwestern Willow Flycatcher breeding habitat is identified during Conservation Measure 1, this habitat will be monitored to quantify changes in the amount and quality of habitat. If suitable breeding habitat is lost or the quality of the habitat declines so that it is no longer considered suitable breeding habitat, this loss will be mitigated through development of replacement habitat at a 1:1 ratio.

Willow Flycatcher Conservation Measure 4- Occupied Habitat Monitoring

If occupied Southwestern Willow Flycatcher breeding habitat is identified in Conservation Measure 2, this habitat will be monitored to quantify changes in the amount and quality of habitat. If occupied breeding habitat is lost or the quality of habitat declines so that it is no longer considered suitable breeding habitat, this loss will be mitigated through replacement at a 2:1 ratio.

Willow Flycatcher Conservation Measure 5- Management and Monitoring of Habitat

A long-term management plan will be developed for any mitigation habitat acquired or created, including a monitoring plan.

1.4.5 California Brown Pelican (*Pelecanus occidentalis californicus*

Most California Brown Pelican use of the Salton Sea is by post-breeding visitors, with more limited use for wintering. These visitors are mostly young birds that disperse northward from breeding areas in the Gulf of California (Hazard, personal communication). The primary mechanism through which IID's water conservation activities could result in take of California Brown Pelicans at the Salton Sea is a reduction in fish abundance.

Brown Pelican Conservation Measure 1 – Comprehensive Range Surveys

Reclamation, in cooperation with its conservation-agreement partners, proposes to fund comprehensive range surveys in order to assist FWS in determining population status of the California Brown Pelican. The scope of the surveys would be developed in cooperation with the FWS, CDFG, and recognized pelican experts, and would be initiated within one year of issuance of the BO. It is anticipated that FWS and CDFG would oversee the surveys.

Brown Pelican Conservation Measure 2- Increase Breeding Success in Known Nesting Areas

Reproductive success is believed to be a primary determinant of the size and trajectory of California Brown Pelican populations. Reproductive success can be influenced by disturbance, prey availability, and pollutants (see, e.g. Johnsgard 1993). Strong correlations between the occurrence and intensity of human disturbance during the breeding season and reproductive success have been found (Johnsgard 1993). If adults are disturbed they will leave the nest, leaving the eggs or chicks vulnerable to heat, cold and predation.

Reclamation, in cooperation with its conservation-agreement partners, proposes a program to inventory existing and former breeding colonies, and contribute funding to conservation efforts aimed at reducing disturbance of nesting colonies where appropriate. Human disturbance to nesting colonies is a significant threat to colonial seabirds, including the California brown pelican (Velarde and Anderson 1994). The program could include environmental education and monitoring of nesting colonies, which can be effective at increasing breeding success (Velarde and Anderson 1994).

Other actions with potential benefits to brown pelicans that could be realized include improved patrol and enforcement of existing conservation laws and regulations, posting signs around colonies, and conducting education and outreach programs with local people about pelican colonies.

Brown Pelican Conservation Measure 3 – Establishment of a California Brown Pelican Conservation Fund

Reclamation, in cooperation with its conservation-agreement partners, would provide funding to establish a conservation fund which could be used for a broad variety of conservation actions to assist in the recovery of the brown pelican. Such actions could include habitat improvement projects, forage base enhancements, measures to minimize disturbance to nesting colonies, research into the species status and obstacles to recovery, or other actions deemed necessary by FWS and the CDFG. A goal of the conservation fund would be to develop additional data to assist FWS and CDFG to better determine the precise status of the species and to assist in their recovery. Reclamation believes there are opportunities to build upon existing efforts and programs by providing additional resources from the fund.

1.4.6 Bald Eagle (*Haliaeetus leucocephalus*), Mountain Plover (*Charadrius montanus*), and Razorback Sucker (*Xyrauchen texanus*)

Bald eagles may benefit from the managed marsh habitat created for Yuma clapper rails by using it as foraging habitat. The Conservation Plan does not include specific elements for Bald eagles, Mountain plovers, or Razorback suckers. This is because Reclamation has concluded IID's water conservation measures will not adversely affect these three species, and take is not anticipated. The analysis which supports this conclusion is included in Chapter 4.

CHAPTER 2

Environmental Baseline: Physical and Biological Environment

2.1 Location and Regional Setting

The project area contains IID's water service area, which is in the Imperial Valley in the southeast corner of California, east of Los Angeles and San Diego. The Imperial Valley lies in the Salton Trough (Cahuilla Basin), an area of very flat terrain. The Salton Trough encompasses a large portion of the Colorado Desert (a subdivision of the Sonoran Desert, extending through portions of Mexico and Southern Arizona), with much of the area below sea level.

2.2 Physical Environment

2.2.1 Climate

The Imperial Valley is one of the most arid regions in the United States. The climate of the project area is typical of desert regions, with hot, dry summers and high winds, with occasional thunderstorms and sandstorms. Summer air temperatures typically are above 100°F and can reach 120°F. Winter temperatures generally are mild, usually averaging above 40°F, but frost may occur occasionally.

The prevailing winds in the Imperial Valley are from the west. Average wind speeds range from 4 to 7 miles an hour. However, at the Salton Sea, the winds are predominantly from the east in the northern portions of the Sea, while in the southern portions of the Sea, westerly winds predominate similar to the rest of the Imperial Valley.

Rainfall can occur from November through March, but because the area is in the rain shadow of the Peninsular Ranges, it receives little precipitation. The 85-year average annual rainfall is 2.93 inches. June is the driest month; precipitation in June has only occurred three times during the period of record. Snowfall has been recorded only once.

2.2.2 Geology and Soils

The Salton Trough is the most dominant landform in Imperial County. Approximately 130 miles long and 70 miles wide, the Salton Trough is a seismically active rift valley and encompasses the Imperial Valley, Mexicali Valley, and Gulf of California in Mexico in the south and the Coachella Valley in the north. The Salton Sea is in the northern portion of the Salton Trough.

As discussed previously, the basin topography is relatively flat with little topographic relief. The Sand Hills are an area of windblown sand deposits that form a 40-mile-long by 5-mile-wide belt of sand dunes extending along the east side of the Coachella Canal from the Mexican border northward. In the Coachella and Imperial Valleys, an old lake shoreline (Lake Cahuilla) has been identified by the presence of lacustrine deposits. The Imperial

Formation, which is marine in origin, underlies the sequence of sedimentary layers in the basin. The Imperial Formation is underlain by igneous and metamorphic basement rocks (Reclamation and SSA, 2000).

In the dry climate of Imperial County, soils, unless they are irrigated, have no potential for farming (County of Imperial, 1997). Lacustrine basin soils in the Imperial Valley formed on nearly level old lake beds in the area of ancient Lake Cahuilla. These soils generally consist of silty clays, silty clay loams, and clay loams and are deep, highly calcareous, and usually contain gypsum and soluble salts. The central irrigated area served by IID generally has fine-texture silts and is primarily used for cropland. Continued agricultural use of soils required installation of subsurface tile drains to carry away water and salts that would otherwise build up in the soils and prevent crop growth. Tile drains discharge this flow to surface drains (IID, 1994). Sandy soils, typical of the deserts in the southwest United States, are predominant in higher elevations, such as the East and West Mesas, and generally are used for recreation and desert wildlife habitat. The irrigated portion of Imperial Valley generally is flat and has low levels of natural erosion.

The Imperial Valley is in one of the most tectonically active regions in the United States, and, therefore, is subject to potentially destructive and devastating earthquakes. Additionally, the Imperial Valley is susceptible to other geologic hazards, including liquefaction and flooding.

2.2.3 Hydrology and Water Quality of the Imperial Valley

Surface water comes primarily from two sources: the Colorado River and inflow across the International Boundary from Mexico via the New River. Agricultural production served by IID is almost entirely dependent on surface water diverted from the Colorado River into the IID distribution system. After application to farm fields for irrigation purposes, the water is collected in drains. The drains transport water directly to the Salton Sea or to the New or Alamo Rivers that discharge to the Salton Sea. With no outlet, the Salton Sea is a terminal sink for drain water from Imperial Valley.

2.2.3.1 Hydrology

Irrigation Delivery Water

The IID water distribution system begins at the Colorado River, where water is diverted at Imperial Dam and conveyed by gravity through the All American Canal (AAC). The AAC discharges water to three major distribution canals in the IID service area: the East Highline, Central Main, and Westside Main Canals. These three canals serve as the main arteries of a system consisting of approximately 1,667 miles of canals and laterals that distribute irrigation water in IID's service area.

Flow measurements collected from 1987 through 2000 at Drop No. 1 (just before the AAC enters the IID Service Area) show that Colorado River irrigation deliveries to IID ranged from approximately 2.57 MAFY to more than 3.15 MAFY. The average annual delivery of irrigation water during the same period is approximately 2.97 MAFY. Colorado River diversions account for approximately 90.5 percent of all water flowing through IID. Remaining water components flowing through IID include flow from the New River across the International Boundary at approximately 5 percent, rainfall at approximately 4 percent, net groundwater discharge to the irrigation system of less than 1 percent, and flow from the Alamo River across the International Boundary at less than 0.1 percent.

The delivery of Colorado River water to IID is driven by user demand. This demand is not constant throughout the year but varies because of a combination of influences, such as changes in climate and local rainfall conditions, crop cycles, and government crop programs. Demand is typically highest in April and remains fairly high until August when it starts to decline.

Colorado River water imported by IID is either used consumptively or is collected in surface drains or rivers. Consumptive use includes transpiration by crops and evaporation directly from soil or water surfaces. Approximately 66 percent of the water that is delivered for on-farm use is used for crop production and leaching, and roughly 3 percent is lost to evaporation. The remaining water delivered for on-farm use discharges into the IID drainage system as surface runoff or is lost to shallow groundwater.

Drainage Water

The IID drainage system includes a network of surface and subsurface drains. Water entering the drainage system can originate from the following sources:

- Operational discharge (i.e., water that has traveled through portions of the IID water conveyance system and was not applied to land). The main components of operational discharge are canal seepage and canal and lateral spillage. Canal and lateral spillage refers to unused water that is discharged from the delivery system to the surface drains or river systems.
- On-farm tailwater runoff (i.e., surface water runoff occurring at the end of an irrigated field).
- On-farm leaching (i.e., water passing the crop root zone that normally enters a tile drain; also referred to as tilewater).
- Stormwater runoff.
- Groundwater.

Water collected by the tile drainage systems either flows by gravity or is pumped to surface drains, which discharge to the Salton Sea either directly or via the New and Alamo Rivers. With the exception of drainage water that is returned to the fields as irrigation water or flow lost to shallow and deep groundwater aquifers (through deep percolation that is not captured by tile drains), all flow collected by the IID drainage system is ultimately conveyed to the Salton Sea.

Water applied to fields in the IID service area serves two purposes: to replenish moisture in the crop root zone and to leach accumulated salts from the soils. According to a recent study by IID, approximately 15 percent of the water applied to fields runs off as tailwater. Except in those fields with tailwater recovery systems, this water is no longer available for on-farm use and is discharged into surface drains or rivers. Approximately 16 percent of irrigation water delivered to fields is used for leaching salts accumulated in soils. This water percolates to the tile drainage system, where it is collected and conveyed to the IID surface drains.

Collectively, tilewater and tailwater drainage accounts for roughly 67 percent (34 and 33 percent, respectively) of all IID drainage discharged to the Salton Sea either directly or via the New and Alamo Rivers. The Alamo River receives approximately 61 percent of the discharge from the IID drainage system, and the New River receives roughly 29 percent of the discharge. The remaining 10 percent is discharged from the drainage system directly to the Salton Sea. Total IID discharge to the Salton Sea averaged about 1.16 MAFY during 1986 to 1999.

Alamo River

The Alamo River enters IID from Mexico. Currently, there is no flow in the Alamo River coming from Mexico across the International Boundary because of the installation of a dam by Mexico at the boundary in 1996. However, the previous 5-year average annual flow volume at the US/Mexico border was less than 2 KAFY. The Alamo River receives drainage from about 58 percent of the IID area and accounts for about 61 percent of IID's drainage discharge. Outflow from the Alamo River to the Salton Sea is estimated at about 605 KAFY, with about 168 KAF from rainfall, municipal, industrial, and operational discharge, and seepage; 211 KAF from tailwater; and 223 KAF from tilewater.

New River

The New River also enters IID from Mexico, but, unlike the Alamo, the New River serves as an open conduit for untreated municipal sewage, heavy metals, and agricultural drainage waters high in pesticide residues from northern Mexico. The average annual flow volume of the New River at the International Boundary from 1987 to 1998 was about 165 KAFY, which comprised approximately one-third of the total flow of the New River at its discharge to the Salton Sea. Therefore, the New River is a significant source of pollutant loading into the Salton Sea. Water demand and discharges in Mexico might impact annual flows, and flow volumes at the boundary have changed dramatically during the period of record. Gage data show flow in the New River at an average annual low of 41 KAFY from 1950 to 1957, increasing to an average of 110 KAFY from 1958 to 1978. Flows across the boundary increased again to an annual average of 150 KAFY during 1979 to 1982, and then again from 1983 to 1988 to values higher than 250 KAFY. The discharge from Mexico leveled back to approximately 100 KAFY from 1987 to 1999.

The New River receives approximately 29 percent of the drainage from IID, and including input from Mexico, accounts for about 39 percent of the total discharge from the IID water service area to the Salton Sea. The average annual flow from the New River to the Salton Sea is made up of approximately 81 KAFY from rainfall, municipal and industrial effluent, IID operational discharge, and canal seepage; 102 KAFY from tailwater; and 108 KAFY from on-farm tile drainage, for a total of 291 KAFY, with the remainder of the flow coming from Mexico and net river losses.

2.2.3.2 Water Quality in Rivers and Conveyance System

Water quality in the project area is determined by the quality of water diverted from the Colorado River, the quality of water in the New River as it crosses the International Boundary, and agricultural practices. The following sections summarize water quality information for:

- Irrigation delivery water
- Drainage water
- Alamo River water
- New River water

Table 2.2-1 summarizes water quality data for selenium and salinity in irrigation delivery water, drainage water, and New River and Alamo River water. Information from two data sets is summarized: (1) "recent" water quality data and (2) "long-term" water quality data. The recent water quality data consist of data obtained during a coordinated monitoring effort at the following locations:

- AAC
- Surface drains that discharge to the Alamo River
  - South Central Drain
  - Holtville Main Drain
- Surface drains that discharge to the New River
  - Greeson Drain
  - Trifolium 12 Drain
- New River at the International Boundary
- New River at the outlet to the Salton Sea
- Alamo River at the outlet to the Salton Sea

The water quality information contained in this data set was collected and compiled by the Colorado River Basin Regional Water Quality Control Board from 1996 through 1999. The information represents the most current water quality data available. The data were collected from each of the sampling locations listed above during the same time period.

The long-term water quality data set includes data collected during numerous monitoring events from sites throughout the IID service area. This is a subset of a database that was compiled for modeling purposes and obtained from various sources, including the U.S. Environmental Protection Agency's Storage and Retrieval Environmental Data System, U.S. Geological Service's Water Quality Network, Colorado River Basin Regional Water Quality Control Board data, and published and unpublished papers and documents.

The data are reported as mean concentrations of cumulative flows at the following locations:

- IID irrigation delivery water at the AAC
- Alamo River drainage basin
  - Alamo River at the International Boundary
  - IID surface drain discharge to the Alamo River
  - Alamo River at the Salton Sea
- New River drainage basin
  - New River at the International Boundary
  - IID surface drain discharge to the New River
- New River at the Salton Sea

Surface water that is diverted from the Colorado River is the only water available to IID for agricultural use, except rainfall and minor contributions from groundwater sources. Chemical characteristics of the water entering the IID agricultural area change little between the source at the Colorado River and the points where the water enters delivery systems of the individual fields.

TABLE 2.2-1
Recent[a] and Long Term[b] Mean Flows and Concentrations for Water Quality Parameters in IID's Service Area

	Colorado River Irrigation Delivery in AAC		New River							Alamo River						
	Long Term 1970-99	Recent 1996-99	Long Term 1970-99			Recent 1996-99				Long Term 1970-99			Recent 1996-99			
Parameter	AAC	AAC	Mexico Border	Surface Drains	Outlet to Salton Sea	Border	Greeson	Trifolium 12	Outlet to Salton Sea	Mexico Border	Surface Drains	Outlet to Salton Sea	Border	South Central	Holtville Main	Outlet to Salton Sea
Daily mean flow (cfs)	3,934	—	250	—	622	—	—	—	—	—	—	843	—	—	—	—
Instantaneous flow (cfs)	—	—	193	—	—	—	—	—	—	2	—	—	—	—	—	—
TDS (mg/L)	771	773	3,894	2,116	2,997	2,676	2,033	2,143	2,743	3,191	2,375	2,458	—	2,269	2,347	2,318
TSS (mg/L)	86	11	117	193	313	52	188	189	241	360	318	479	—	329	175	300
Se (µg/L)	2.5	2.12	3.0	7.4	7.1	ND[c]	5.24	6.03	4.09	5.9	7.9	7.7	—	8.77	5.63	7.53

[a] Data collected by the Colorado River Basin Regional Water Quality Control Board during 1996 through 1999.
[b] Data collected during 1970 to 1999 and compiled from various sources (see text for greater explanation).
[c] A 5 µg/L detection limit was used for this sample.
— Data Not Available

Recent water quality data (1996 to 1999) collected from the AAC show the following:

- Concentrations for selenium range from 1.94 to 2.42 micrograms per liter (μg/L), and concentrations for boron range from 110 to 190 μg/L. Mean concentrations for selenium and boron are 2.12 and 142.5 μg/L, respectively.
- Mean concentrations for selenium and boron from 1970 through 1999 are similar to concentrations shown in the recent data.

Water quality data for total dissolved solids (TDS) show that the annual mean concentration for 1970 through 1999 is 771 milligrams per liter (mg/L). Mean concentrations in the irrigation delivery water were highest during the late 1970s and early 1980s, with concentrations more than 850 mg/L. Starting in 1983, TDS concentrations in the influent decreased to a low of about 525 mg/L in 1986. The major factor contributing to this fluctuation was the unusually high flows carried by the Colorado River during the mid-1980s. Since 1986, TDS concentrations in the irrigation delivery water have gradually increased. Recent data from 1996 to 1999 show that TDS concentrations range from 720 to 820 mg/L, and the average concentration for TDS during this period is 772.5 mg/L.

Drainage Water

Water entering the drainage system primarily comes from three sources: operational discharge, tailwater, and tilewater. Analysis of water discharging to the drainage system indicates the following:

- Operational discharge is considered to have the best water quality because it is not applied to the land and, thus, it should be similar in quality to water entering the IID service area directly from the Colorado River.
- Tailwater is considered the next best in terms of quality. However, tailwater accumulates certain amounts of sediment and solutes (including agricultural chemicals, such as fertilizers and pesticides) from the soil as it flows across the cultivated fields.
- Tilewater is generally considered the poorest of water sources because dissolved salts and other constituents tend to concentrate in the water as it percolates through the root zone and is collected in the subsurface drainage collection system.

Alamo River Basin

Recent water quality data for South Central and Holtville Main drain show the following:

- Selenium concentrations in the South Central drain at its outlet range from 5.43 to 11.30 μg/L, and the mean concentration is 8.77 μg/L. Selenium concentrations in the Holtville Main drain range from 4.30 to 10.0 μg/L, and the mean concentration is 5.63 μg/L.
- TDS concentrations in the South Central drain range from 1,510 to 3,000 mg/L, and the mean concentration is 2,269 mg/L. TDS concentrations in the Holtville Main drain range from 1,990 to 3,120 mg/L, and the mean concentration is 2,347 mg/L.

Long-term mean concentrations for selenium and TDS in surface drains in the Alamo River drainage basin are 7.9 μg/L, 683 μg/L, and 2,375 mg/L, respectively.

New River Basin Drains

Based on the recent water quality data set, the range (minimum and maximum) and mean concentration values for selenium and TDS in the Greeson and Trifolium 12 drains are discussed below:

- Selenium concentrations in the Greeson drain range from 3.58 to 6.76 µg/L, and the mean concentration is 5.24 µg/L. Selenium concentrations in the Trifolium 12 drain range from 3.01 to 15.0 µg/L, and the mean concentration is 6.03 µg/L.
- TDS concentrations in the Greeson drain range from 1,490 to 2,840 mg/L, and the mean concentration is 2,033 mg/L. TDS concentrations in the Trifolium 12 drain range from 1,260 to 4,380 mg/L, and the mean concentration is 2,143 mg/L.

The recent data set for the Greeson and Trifolium drains are useful for comparing water quality trends and values in these drains. However, data from these two drains may not be representative of the entire New River drainage system.

Long-term mean concentrations for selenium and TDS in surface drains in the New River drainage basin are 7.4 µg and 2,116 mg/L, respectively. Overall, the long-term constituent concentration values in the New River drains are similar to the long-term concentration values observed in the Alamo River drains.

Alamo River

Flow at the International Boundary with Mexico is less than 1 percent of the Alamo River's discharge to the Salton Sea. As such, water quality and quantity at the Alamo River outlet are almost totally a function of drainage from IID. Based on the recent water quality data set, the range (minimum and maximum) and mean concentration values for selenium and TDS at the International Boundary are:

- Selenium concentrations range from 3.0 to 10 µg/L, and the mean concentration is 5.9 µg/L.
- TDS concentrations range from 1,866 to 4,260 mg/L, and the mean concentration is 3,191 mg/L.

Recent water quality data for the Alamo River at its outlet to Salton Sea show the following:

- Selenium concentrations range from 5.5 to 13.0 µg/L, and the mean concentration is 7.53 µg/L.
- TDS concentrations range from 1,920 to 3,300 mg/L, and mean concentration is 2,318 mg/L.

These concentrations are similar to concentration values found in drains that discharge to the Alamo River.

New River

The New River also enters IID from Mexico, but unlike the Alamo, the New River serves as an open conduit for untreated sewage, heavy metals, and pesticide residues from northern Mexico. Recent water quality data for the New River at the International Boundary show the following:

- Selenium concentrations were less than 5 µg/L and boron was not analyzed in water quality samples collected at the International Boundary.

- TDS concentrations range from 1,970 to 3,480 mg/L, and the mean concentration is 2,676 mg/L.

Long-term mean concentrations for selenium and TDS in the New River at the International Boundary are 3 μg/L and 3,894 mg/L, respectively. Recent water quality data (1996 to 1999) for the New River at its outlet with the Salton Sea generally show the following:

- Selenium concentrations range from 2.93 to 11.0 μg/L, and the mean concentration is 4.09 μg/L.
- TDS concentrations range from 2,320 to 3,740 mg/L, and mean concentration is 2,743 mg/L.

Long-term mean concentrations for selenium and TDS in the New River outlet to the Salton Sea are 7.1 μg/L and 2,997 mg/L, respectively.

2.2.4 Biological Environment

2.2.4.1 Overview of the Biological Environment

The project area lies in the California Desert. Before European settlement, the area consisted of native desert vegetation and associated wildlife. Periodically, the Colorado River changed course and flowed northward into the Salton Trough forming a temporary, inland sea. These former seas persisted as long as water entered from the Colorado River, but evaporated when the river returned to its previous course. Thus, despite the periodic occurrence of a lake in the Salton Trough, the project area consisted predominantly of a desert ecosystem.

The Salton Sea represents the remnants of the most recent flooding occurrence by the Colorado River, when, in 1905, the river breached an irrigation control structure and flowed into the Salton Trough. Initially, the surface elevation of the Salton Sea reached –197 feet mean sea level (msl), but evaporation reduced its elevation to –248 feet msl by 1920 (Service, 1999). By this time, agricultural production had increased in both the Imperial and Coachella Valleys, and the Salton Sea was receiving drainage water. In 1924 and 1928, presidential orders withdrew all federal lands below –220 feet msl "for the purpose of creating a reservoir in the Salton Sea for storage of waste and seepage water from irrigated land in Imperial Valley." Since its formation in 1905, the Salton Sea has been sustained by irrigation return flows from the Imperial and Coachella Valleys.

The availability of a reliable water supply, effected by construction of Hoover and Imperial Dams and the AAC, allowed the Imperial Valley to be brought into intensive cultivation. To support agricultural production in the valley, an extensive network of canals and drains was constructed to convey water from the Colorado River to farmers in the valley and subsequently to transport drainage water from the farms to the Salton Sea. The importation of water from the Colorado River and subsequent cultivation of the Imperial Valley radically altered the Salton Trough from its native desert condition. The availability of water in the drains and canals supported the development of mesic (marsh-associated) vegetation and, in some locations, patches of marsh-like habitats (e.g., along the Salton Sea and seepage from canals). These mesic habitats, in addition to the productive agricultural fields, attracted, and currently support numerous species of wildlife that would be absent or present in low numbers in the native desert habitat. Today, small areas of native desert habitat persist in the project area, but mainly the project area supports habitats created and maintained by water imported to Imperial Valley for agricultural production.

2.2.4.2 Threatened, Endangered, Proposed and Candidate Species in Imperial County

Table 2.2-2 lists the Threatened, Endangered, Proposed and Candidate species known to occur in Imperial County, California, with their potential for occurrence in the Imperial Valley and Salton Sea

TABLE 2.2-2
Federally Threatened, Endangered, Proposed, and Candidate Species Potentially Occurring in the Imperial Valley and Salton Sea and General Habitat Associations

Common Name/ Scientific Name	Federal	Status State	General Occurrence	General Habitat
Plants				
Coachella Valley milk-vetch/ *Astragalus lentiginosus var. coachellae*	FE			D
Peirson's milk-vetch/ *Astragalus magdalenae var. peirsonii*	FT	SE		D
Triple-ribbed milk-vetch/ *Astragalus tricarinatus*	FE			D
Parish's daisy/ *Erigeron parishii*	FT			D
Fish				
Desert pupfish/ *Cyprinodon macularius*	FE	SE	R	A
Razorback sucker/ *Xyrauchen* texanus	FE	SE	R	A
Reptiles				
Desert tortoise/ *Gopherus agassizi*	FT	ST	R	D
Aleutian Canada goose/ *Branta canadensis leucopareia*	DM		W	Ag, W
Birds				
Mountain Plover/ *Charadrius montanus*	FPT		W	Ag
Western Yellow-billed Cuckoo/ *Coccyzus americanus occidentalis*	C	SE	M	R
Southwestern Willow Flycatcher/ *Empidonax traillii extimus*	FE	SE	M	R
Peregrine Falcon/ *Falco peregrinus*	DM	E	M	G
Bald Eagle/ *Haliaeetus leucocephalus*	FT	SE	W	W, A
Brown Pelican/ *Pelecanus occidentalis*	FE	SE	S	A
Yuma Clapper Rail/ *Rallus longirostris yumanensis*	FE	ST	S	W
California Least Tern/ *Sterna antillarum browni*	FE	SE	S	A

TABLE 2.2-2
Federally Threatened, Endangered, Proposed, and Candidate Species Potentially Occurring in the Imperial Valley and Salton Sea and General Habitat Associations

Common Name/ Scientific Name	Federal	Status State	General Occurrence	General Habitat
Least Bell's Vireo/ *Vireo bellii pusillus*	FE	SE	M	R

Key
FE: Federally Endangered
FT: Federally Threatened
FPT: Proposed Threatened
C: Candidate
ST: State Threatened Concern
SE: State Endangered
DM: Federal Delisted – Monitored
Habitat Codes
W: Wetland Habitat
A: Aquatic Habitat, predominantly Salton Sea
Ag: Agricultural fields
R: Riparian
G: Generalist at this level and/or requires presence of specific microhabitat features to persist in area
D: Desert dunes/ scrub
Occurrence Codes
N: Does not occur in Project area
M: Migrates through Project area
S: Summer resident in Project area
W: Winter resident in Project area
R: Year-long resident in Project area
Sources
CDFG 1999; Service 1999.

Only species with a moderate to high probability of occurring in the project area are evaluated in this BA. Species meeting one or more of the following criteria were determined not to occur or to be affected in the project area and are not evaluated in this report.

- The project area is outside the species' potential range.
- The species is not known to occur in or near the project area.
- Suitable habitat for the species is not present in or adjacent to the project area.
- The species may occur but only rarely and irregularly in project area habitats, and does not use the area for breeding.

Based on known and historical occurrences and habitat requirements of the species listed above, the following federally listed species are considered in the effects analysis: desert pupfish, razorback sucker, Mountain Plover, Bald Eagle, Yuma Clapper Rail, Brown Pelican, and Southwestern Willow Flycatcher.

Although the California Least Tern is listed as a summer resident, it occurs at the Salton Sea very infrequently. Less than 10 records of this species exist at the Salton Sea NWR (Service, 1997a). Nesting has not been reported, and based on the low level of use of the Salton Sea by California least terns, nesting is not currently expected. Given the low probability of this species' occurrence in the project area, and lack of nesting records, it is not included here.

2.2.4.3 Fish and Aquatic Habitat

Aquatic habitat occurs in the project area in the IID water service area's conveyance system and drainage infrastructure and in the New and Alamo Rivers. The Salton Sea also provides aquatic habitat and is discussed in a subsequent section.

Conveyance System

IID maintains 1,667 miles of canals in its service area, which distribute water diverted from the LCR to farms in the Imperial Valley. Most of the canals are concrete lined (1,114 miles). About 16 miles of the system are pipelines; the remaining 537 miles are earthen canals. IID also operates the 82-mile AAC, which conveys water from Imperial Dam to IID's conveyance system in the valley. The AAC is unlined, but portions are planned to be concrete lined in the future (Reclamation and IID, 1994).

2.2.4.4 Wildlife Habitat

Drain Habitat

Wet area habitats in the project area are collectively referred to as drain habitat. Drain habitat occurs in association with the drainage system, conveyance system, in managed marshes on the state and federal refuges and on private duck clubs, and as unmanaged vegetation adjacent to the Salton Sea.

Drainage System

Currently, IID operates and maintains 1,456 miles (cited from IID Memorandum, dated October 4, 2000) of agricultural drains. These drains typically are unlined, dirt channels with 65 miles of the drainage network in buried pipes. Main drain channels have an average depth of 8 to 11 feet, with a typical side-slope embankment ratio of 1:1. Lateral ditches have an average depth of 7 feet, with a typical side-slope embankment ratio of 1:1. Some drainage channels are steep-sided, with sloughing embankments from years of erosion prior to stabilization; others are sloped more gradually. Water flow in drains is determined by the collective irrigation practices on fields adjacent to the drains. Drains contain flows during irrigation, and storms may add to flows. Peak flows occur during storms and during the months of April and May.

Vegetation in the drains is limited to the embankment slope or sediments directly in the drain channel and typically consists of invasive species, such as saltgrass, salt bush, Bermuda grass, common reed, and tamarisk (also known as salt cedar). Vegetation adjacent to the edge of the water typically is restricted to a narrow strip from 3 to 15 feet wide, with more drought-tolerant vegetation on drain embankments. Some drain banks are devoid of vegetation, with only a narrow band of saltgrass or Bermuda grass adjacent to the edge of the water. Cattail, bulrushes, rushes, and sedges, occur in drain channels, typically in sparse, isolated patches. More extensive stands of cattail/bulrush vegetation may persist where maintenance activities are infrequent. In addition, stands of common reed and cattails can occur at the mouths of drains, where they empty into rivers or the Salton Sea. Table 2.2-3 lists typical plant species occurring in irrigation drains in the Imperial Valley.

Vegetation is cleared from drains primarily via mechanical means; occasionally vegetation is controlled by prescribed burns or by chemical and biological control methods. Drains are cleaned on an as-needed basis, depending on the extent of sediment and vegetation accumulation. Drains with the lowest gradient accumulate sediment more rapidly and may require cleaning annually. Other drain segments may not require cleaning for periods of 10 years or more. Maintenance activities limit the extent of vegetation supported in the drains.

TABLE 2.2-3
Typical Plant Species Occurring in Drains in Imperial Valley

Species Name	
Adenophyllum porophylloides (false odora)	*Leptochloa uninerva (mexican sprangletop)*
Allenrolfea occidentalis (iodine bush)	*Malvella leprosa (alkali mallow)*
Aristida oligantha (prairie three awn)	*Paspalum dilatatum (dallisgrass)*
Atriplex sp. (saltbush)	*Phragmites communis (common reed)*
Baccharis emoryi (Emory's baccharis)	*Polygonum aviculare (prostrate knotweed)*
Bassia hyssopifolia (five-hook bassia)	*Polygonum sp. (knotweed)*
Carex sp. (sedge)	*Polypogon sp. (beard grass)*
Chamaesyce melanadenia (prostrate spurge)	*Prosopis sp. (mesquite)*
Croton californicus (croton)	*Psilostrophe cooperi (paper-daisy)*
Cryptantha sp. (popcorn flower)	*Rumex crispus (curly dock)*
Cynodon dactylon (desert tea)	*Salsola tragus (Russian thistle)*
Eriogonum sp. (buckwheat)	*Scirpus sp. (bulrush)*
Heliotropium curassavicum (alkali heliotrope)	*Sesbania exaltata (Colorado river hemp)*
Juncus sp. (rush)	*Suaeda moquinii (sea-blite)*
Lactuca serriola (prickly lettuce)	*Tamarix sp. (tamarisk or salt cedar)*
Larrea tridentata (creosote bush)	*Typha sp. (cattail)*
Leptochloa fascicularis (bearded sprangletop)	

Sources: IID, 1994; Reclamation and SSA, 2000.

Hurlbert et al. (1997) surveyed drains in the project area. In this study, the percent cover for each of the major plant species (e.g., *Phragmites, Tamarix, Pluchea, Typha,* and *Atriplex*) and habitat type (e.g., herbaceous, bare ground, and other) was estimated in 10 drains. Each drain was surveyed by driving its length and stopping every 0.1 mile. At each stop, percent coverage for each major vegetation species (*Phragmites, Tamarix, Pluchea, Typha,* and *Atriplex*) or habitat type (herbaceous, bare ground, and other) was determined in the area extending 100 feet on either side of the point. The survey was conducted in the winter (late 1994/early 1995) and spring (late May 1995). Based on these data, Hurlbert et al. (1997) calculated the average percentage cover of each major vegetation species in each drain separately for the winter and spring surveys. The 10 drains surveyed were distributed throughout Imperial Valley and covered about 78 miles.

Hurlbert et al. (1997) summarized these data in two ways. First, the percentage of the total drain covered by the major vegetation species and cover categories was calculated. This method provides the most accurate characterization of the plant species composition and percentage of the drain supporting vegetation. The second method of summarizing the data focused on habitat characteristics rather than plant species composition. In this method, survey locations with less than a median of 15 percent vegetation cover were classified as bare ground/herbaceous. Survey locations with between 15 and 37.5 percent vegetation cover were classified as sparse cover.

Based on data collected, the average percentage cover of each major vegetation species in each drain was calculated for the winter and spring surveys. Studies indicate that common reed (*Phragmites* sp.) is the most prevalent plant species. Cattails are uncommon and occur in small, localized areas. With the exception of small, localized areas of cattails and occasionally bulrushes, the drains do not support emergent vegetation. As such, habitat availability and quality for marsh-associated species are poor.

The data reported by Hurlbert et al. (1997) were used to estimate the acreage of vegetation supported by IID's drainage network. Hurlbert et al. (1997) only characterized vegetation between the drain banks. A standard lateral drain (excluding the water surface) is about 14 feet wide at the top of the drain embankment. Assuming all drains are 14 feet wide, the 1,456 miles of drains in the Imperial Valley cover 2,471 acres; however, potential habitat includes only a small proportion of the drains. Acres of vegetation supported by the entire drainage system were calculated based on the percentage vegetation supported by the drains surveyed weighted by the drain's length. With this method, an estimated 652 acres of vegetation are supported in the drains. Good water quality combined with the drain's large size results in Holtville Main Drain supporting substantially more vegetation than is typical for drains. As shown by Hurlbert et al.'s data, Holtville Main Drain is 56 percent vegetated while the next most vegetated drain (Trifolium 2) is only 23 percent vegetated. The remaining drains surveyed have less vegetation. Holtville Main Drain was also the longest drain surveyed at 17.8 miles followed by South Central Drain at 12.2 miles. Because the estimate of the amount of vegetation in the drainage system was derived from the percentage of vegetation in each of the drains surveyed weighted by their lengths, inclusion of Holtville Main Drain (the longest drain with an atypical amount of vegetation) may have resulted in an overestimation of the amount of vegetation in the entire drainage system.

Only a small proportion of the vegetated acreage consists of cattails, which are favored by wildlife species associated with drain habitats, including the Yuma Clapper Rail. The Holtville Main Drain had the greatest percentage of cattails at 6.3 percent followed by the South Central, Warren, and Mesquite Drains at 3.8, 1.5, and 1.1 percents, respectively. The remaining five drains did not support cattails. For the nine drains, the average percent cover of cattails weighted by drain length was 2.5 percent. Based on this average, the entire IID drainage system supports about 63 acres of cattail vegetation.

Conveyance System

Approximately 70 percent of the 1,667 miles of canals in Imperial Valley are concrete lined or in pipes and, therefore, do not support rooted vegetation. Embankment slopes of the lined canals also are maintained free of vegetation. About 537 miles (cited from IID Memorandum, dated October 4, 2000) of the delivery system is earthen channels. The canal slopes can support vegetation that typically consists of bands of vegetation at the water surface. The bands of vegetation consist of common reed, saltgrass, Bermuda grass, and seedling tamarisk. Tree and shrub cover are rare or nonexistent on most canals and laterals.

Seepage communities along Imperial Valley canals are rare and generally limited to areas adjacent to the East Highline Canal. System-based water conservation activities undertaken as a result of potential water shortages may result in IID installing seepage recovery systems along portions of the west side of the East Highline Canal. The plant species composition of the seepage communities is diverse and varies substantially among the seepage areas. Arrowweed, common reed, and tamarisk are the most common species in the seepage communities, with mesquite, cattails, and a few cottonwoods present in some areas. About 412 acres of vegetation supported by seepage from the East Highline Canal occurs in areas where seepage recovery systems are under consideration.

Unmanaged Vegetation Adjacent to the Salton Sea

Vegetation has naturally developed in some locations along the margins of the Salton Sea. This phreatophytic vegetation occurs above the shoreline and shoreline strand community (see the following discussion of tamarisk scrub habitat). Unmanaged vegetation includes diked wetlands that are below the water surface elevation of the Salton Sea. The Salton Sea database (University of Redlands 1999) refers to these unmanaged areas of phreatophytic vegetation as adjacent wetlands.

The Salton Sea database (University of Redlands, 1999) classifies 6,485 acres along the Salton Sea as adjacent wetlands and 64 acres as mudflat. Tamarisk and iodine bush are the most common species of adjacent wetlands. Cattails and bulrushes are identified as the primary vegetation on 217 acres of adjacent wetlands. The primary vegetation of areas classified as wetland are presented in Table 2.2-4.

TABLE 2.2-4
Primary Vegetation of Areas Classified as Adjacent Wetlands in the Salton Sea Database

Primary Vegetation	Total Acres at Salton Sea	Percentage of Adjacent Wetlands	Acres in Project Area
Iodine bush	1,577	24	1,509
Mixed halophytic shrubs	65	1	-
Arrowweed	597	9	-
Bulrush	17	<1	17
Sea-blite	86	1	86
Tamarisk	2,349	36	437
Cattail	200	3	67
No primary wetland vegetation	1,595	25	1,305
Total	**6,485**		**3,421**

Source: Salton Sea Database (University of Redlands, 1999)

Managed Marsh

Managed marsh consists of areas that are actively managed for one or more marsh habitat values and functions. In the project area, managed marsh occurs primarily on the state and federal refuges. Private duck clubs also support managed marsh.

The Imperial Wildlife Area, managed by the CDFG, and the Sonny Bono - Salton Sea National Wildlife Refuge, managed by the Service lie in the project area. Both refuges were originally established to provide winter habitat for migratory waterfowl, but are now also managed to provide high quality, year-round marsh habitat for the Yuma Clapper Rail and a wide array of resident and migratory wildlife. Both the Imperial Wildlife Area and Sonny

Bono - Salton Sea National Wildlife Refuge receive irrigation delivery water from IID. Agricultural drainage water is not used on the refuges.

The project area also contains 17 private duck clubs, covering about 5,582 acres. Most of the clubs are near the Salton Sea and are managed exclusively to attract wintering waterfowl, although other wildlife will use these marsh areas when available. These managed marsh units are flooded in fall and winter when wintering waterfowl are present in the valley. They are not flooded during other times of the year; therefore, they do not provide habitat for year-round resident wildlife that are associated with marsh habitat. Generally, duck clubs receive irrigation delivery water from the IID.

Tamarisk Scrub Habitat

Native riparian plant communities in the southwestern desert are dominated by cottonwoods and willows, but palo verde and mesquite also occur. Much of the native riparian plant communities in the desert southwest has been replaced by nonnative plant species, particularly tamarisk. Tamarisk scrub communities supplant native vegetation following major disturbance, including alterations in stream and river hydrology, and can form extensive stands in some places. Characteristic species include tamarisk (*Tamarix chinensis, T. ramosissima*), big saltbrush (*Atriplex lentiformis*), *Coldenia palmeri*, and saltgrass (*Distichlis spicata*); associate species can include common reed (*Phragmites communis var. berlandieri*) and giant reed (*Arundo donax*).

In the project area, tamarisk scrub is found along the New and Alamo Rivers. Areas along the New River are composed of a virtual monoculture of tamarisk, with only a few areas of native vegetation. Vegetation along the Alamo River is similarly dominated by tamarisk. Dredging has extended the river channels of both rivers into the Salton Sea. The banks of the extended river channels support a thick strand of tamarisk and common reed.

The width of tamarisk scrub stands adjacent to the New and Alamo Rivers varies substantially along their lengths. Much of the length of the rivers supports only a narrow band of tamarisk of less than 50 feet on both sides of the channels. In more limited portions of the rivers, larger stands of tamarisk have developed that may extend 500 feet or more from the river channel.

Tamarisk scrub occurs in other portions of the project area wherever water is available, including the margins of the Salton Sea. Tamarisk scrub is also one of the major plant species comprising vegetation along the drains and is found in seepage areas adjacent to canals. The project area contains about 438 acres of the tamarisk-dominated areas adjacent to the Salton Sea (University of Redlands, 1999). The source of the water that supports tamarisk adjacent to the Salton Sea is uncertain, but is likely the result of shallow groundwater and seepage rising to the surface at its interface with the sea. In addition to the adjacent wetlands, tamarisk is a primary component of areas designated as shoreline strand community in the Salton Sea database. The shoreline strand community occupies about 293 acres (University of Redlands, 1999) immediately adjacent to the Salton Sea and consists of tamarisk and iodine bush. As with the tamarisk-dominated areas adjacent to the Salton Sea, the source of water supporting this community is undetermined, but is likely the result of shallow groundwater and seepage rising to the surface at its interface with the sea.

Along IID's drainage system, data from Hurlbert et al. (1997) can be used to estimate the acreage of tamarisk scrub supported by the drains. Of the drains surveyed by Hurlbert, the percentage of drain area composed of tamarisk varied from 0 to 29.6 percent, yielding a weighted average percentage of 8.7. Assuming that tamarisk covers 8.7 percent of the drains, the drainage network in the project area supports about 215 acres of tamarisk scrub habitat.

Cottonwood-willow habitat is largely absent from the project area. Cottonwoods and willows occur in seepage communities along the AAC. In addition, some remnant cottonwoods occur in Imperial Valley at distances of 20 to 60 feet from the East Highline Canal (IID, 1994). A few patches of willow also persist along the Alamo River.

Agricultural Field Habitat

Irrigated agricultural land is the predominant land cover type in the Imperial Valley and comprises most of the project area. Agricultural fields attract a variety of wildlife species. The crops grown, the methods used, and the total acreage in production in IID's service area are based on the decisions of individual farmers. Current and anticipated market prices have an important role in the types of crops that are economically beneficial for farmers to grow. As a result, the total acreage in agricultural production and the types and amount of crops grown fluctuate from year to year. The different types of crops and the range of acreage of each of the major crops grown in the service area for 1999 are shown in Table 2.2-5.

2.2.4.5 Salton Sea Habitat

Wildlife use of the Salton Sea itself is based primarily on the abundance of food resources, availability of a large, open body of water, and presence of unique habitat features, rather than vegetation composition. The following discussion focuses on food resources and food chain relationships, and unique habitat features supported by the Salton Sea.

Food Chain Relationships

Fish species inhabiting the Salton Sea are adapted to high-salinity waters. Most of the fish are nonnative species (Setmire et al., 1993) introduced from the Gulf of California by CDFG. Fish found in the Salton Sea include the sport fish sargo (*Anisotremus davidsoni*), orangemouth corvina (*Cynoscion xanthulus*), Gulf croaker (*Bairdiella icistia*), and other fish species listed in Table 2.2-6. Gulf croaker, sargo, and corvina are marine species, while the remaining species are estuarine or freshwater fish with extreme salinity tolerances. Tilapia are the most abundant fish in the Salton Sea. They were introduced into drainage ditches to control aquatic weeds in the late 1960s and early 1970s and were also produced on fish farms close to the Salton Sea. The Salton Sea was colonized by tilapia that escaped from the fish farm and from those stocked in the drainage system. The highest densities were reported from areas around the New and Alamo Rivers and nearshore areas extending about 6,458 feet (600 meters) from the shoreline (Costa-Pierce and Riedel, 2000). Tilapia productivity of the nearshore area has been estimated at 3,600 kilograms/hectare/year, far exceeding productivity of tilapia in tropical lakes (Costa-Pierce and Riedel, 2000). The abundant fish population attracts and supports large numbers of piscivorous birds, particularly during winter.

TABLE 2.2-5
Crops Produced (greater than 200 acres) in IID Service Area During 1999

Crop Description	Acres	Percentage
Alfalfa (all)	192,633	35.56
Sudan grass (all)	62,881	11.61
Bermuda grass (all)	55,179	10.19
Wheat	42,464	7.84
Sugar beets	33,997	6.28
Lettuce (all)	22,558	4.16
Carrots	16,995	3.14
Melons, spring (all)	14,293	2.64
Broccoli	12,305	2.27
Onions	11,526	2.13
Duck ponds (feed)	9,105	1.68
Cotton	7,131	1.32
Ear corn	6,790	1.25
Citrus (all)	6,169	1.14
Asparagus	6,166	1.14
Cauliflower	3,960	0.73
Onions (seed)	3,541	0.65
Potatoes	3,159	0.58
Klein grass	3,113	0.57
Rape	3,034	0.56
Rye grass	3,034	0.56
Vegetables, mixed	2,162	0.40
Watermelons	2,158	0.40
Tomatoes, spring	2,024	0.37
Melons, fall (all)	2,019	0.37
Rapini	1,323	0.24
Fish farms	1,293	0.24
Cabbage	1,284	0.24
Spinach	1,229	0.23
Garbanzo beans	1,057	0.20
Barley	868	0.16
Field corn	844	0.16
Pasture, permanent	701	0.13
Peppers, bell	429	0.08
Garlic	308	0.06
Flowers	279	0.05
Oats	212	0.04

TABLE 2.2-6
Fish Species Present in the Salton Sea

Species Name	
Sargo (*Anisotremus davidsoni*)	Mosquitofish (*Gambusia affinis*)
Gulf croaker (*Bairdiella icistia*)	Longjaw mudsucker (*Gillichthys mirabilis*)
Orangemouth corvina (*Cynoscion xanthulus*)	Sailfin molly (*Poecilia latapinna*)
Desert pupfish (*Cyprinodon macularius*)	Mozambique tilapia (*Oreochromis mossambicus*)
Common carp (*Cyprinus carpio*)	Zill's tilapia (*Tilapia zilli*)
Threadfin shad (*Dorosoma petenense*)	

Source: Black, 1988.

The Salton Sea represents one of the centers for avian biodiversity in the American Southwest, with occurrence records for more than 400 species and an annual average abundance of waterbirds of 1.5 to 2 million (Reclamation and SSA, 2000; Hart et al., 1998; and Shuford et al., 1999). Populations of some species that use the Salton Sea are similarly of regional, continental, or worldwide importance, representing significant portions of the total populations for those species. The Salton Sea is an integral part of the Pacific Flyway, providing an important migratory stopover for fall and spring shorebirds, and supporting large populations of wintering waterfowl. The Salton Sea represents 1 of only 4 remaining interior sites along the Pacific Flyway that supports more than 100,000 shorebirds during migration (Page et al., 1992), with as many as 44 species represented (Shuford et al., 1999). The Salton Sea also supports large breeding populations of waterbirds.

The overall high productivity of the Salton Sea can be attributed to a number of factors, including relatively mild to warm year-round temperatures, ample nutrient input through agricultural runoff and wastewater discharges to the tributary rivers, and a generally high morpho-edaphic index in the Salton Sea. A high morpho-edaphic index reflects the high surface-to-volume ratio of the Salton Sea (i.e., it has a large area but is relatively shallow), which results in a number of conditions that can generate higher productivity (e.g., with more of the water column in the zone of light penetration, there is greater production of phytoplankton and other photosynthetic organisms relative to the overall quantity of water). The higher productivity transfers steadily up the food chain, resulting in higher densities of prey species for birds.

Bird species that forage on fish include cormorants, diving ducks, pelicans, skimmers, terns, egrets, and herons. Species of fish in Salton Sea eaten as prey include tilapia, bairdiella, sargo, mosquito fish, and larval orange-mouthed corvina (Reclamation and SSA, 2000).

Since the early 1990s, there has been an unprecedented series of fish and bird die-offs at the Salton Sea (Service, 2000). Fish kills often are massive, averaging between 10,000 and 100,000 fish, but sometimes several million fish. Fish die-offs produce substantial amounts of carrion for piscivorous birds but can have adverse impacts on bird populations by contributing to disease outbreaks. Causes of the fish die-offs are not always clear, but a number of potential pathogens have been identified; low oxygen levels also could be responsible for some fish kills. Pathogens implicated in fish kills include infestations with a lethal parasitic dinoflagellate (*Amyloodinium ocellatum*) and acute bacterial infections from bacteria of the genus *Vibrio* (Service, 2000).

Large fish kills have been associated with avian botulism die-offs. It is likely that septicemia in fish produces the conditions in the intestinal tract of sick fish that allow botulism spores to germinate and produce the toxin. Birds foraging on sick fish may ingest fatal doses of the botulism toxin (Service, 2000). A large botulism die-off in birds occurred in 1996, when 8,538 American White Pelicans and 1,129 Brown Pelicans died along with large numbers of Great Egret, Snowy Egret, Eared Grebe, Black-crowned Night Heron, and numerous other birds (Jehl, 1996). The total bird mortality in this event was more than 14,000 birds (Service, 1996).

Since 1987, significant avian die-offs have been recorded on an almost annual basis. While avian disease has been present at the Salton Sea for many years, the recent increase of disease occurrence, the magnitude of losses, and the variety of diseases have increased concern for birds using the Salton Sea (Reclamation and SSA, 2000). Significant events have included a die-off of 4,515 cattle egrets in 1989 from salmonellosis; a die-off of an estimated 150,000 Eared Grebes in 1992 from unknown causes; a loss of more than 14,000 birds, including nearly 10,000 pelicans, in 1996 from avian botulism; a die-off of 6,845 birds in 1997; and a loss of 18,140 birds in 1998 from various agents, including avian cholera, botulism, Newcastle disease, and salmonella (Service, 1996).

Habitat Features

Most of the bird activity at the Salton Sea is concentrated at three primary locations. These locations are along the north and south shores (particularly at the New and Alamo River Deltas) and near the mouth of Salt Creek on the eastern shore (Reclamation and SSA, 2000). In these areas, concentrations of breeding colonies for colonial breeding birds occur. Suitable habitat conditions for colonial birds, such as trees or islands, include an easily accessible and abundant food source and nest and roost sites that are generally protected from predators.

Some natural islands are available for nesting at the Salton Sea; however, a number of sites consists of old levees now inundated in sections and separated from the mainland, or other man-made islands. Except Mullet Island at the south end of the Salton Sea, most sites are less than 10,750 square feet in area. Fluctuations in the level of the Salton Sea can increase or decrease the available habitat for island nesting birds.

Nesting islands in the Salton Sea are described in Molina (1996). Nesting habitat for Brown Pelican is present at the Alamo River Delta, where the Brown Pelican has nested since 1996 (Shuford et al., 1999).

2.2.4.6 Water Quality and Biological Resources

Water quality is a concern for biological resources in the Imperial Valley and Salton Sea. In the Imperial Valley, wildlife can be exposed to poor water quality conditions in the drains that carry agricultural drainage water. Much of the drain water empties into the Salton Sea, where wildlife species also can be exposed to poor water quality conditions. The quality of water in drains and the Salton Sea can impact wildlife in a number of ways. Some contaminants (e.g., selenium) can bioaccumulate, having direct or indirect toxic impacts, and reducing immune functions leaving animals more susceptible to disease. Concentrations of other constituents (e.g., salts) can impact survival or reproductive success of aquatic species. Finally, water quality can influence plant species composition of habitats supported along the Salton Sea or in agricultural drains, and thereby alter habitat suitability for species using these habitats. The constituents of greatest concern in the Imperial Valley and Salton Sea and potentially affected by the water conservation and transfer programs are salinity and selenium.

Salinity

Since the Salton Sea has no outlet, high evaporation rates in the area have resulted in increasing salinity of the sea. Reclamation (Reclamation and SSA, 2000) in the recent Salton Sea Restoration Project EIS/EIR theorized that the sea will eventually reach salinity levels that will result in the loss of fish species. The gradual increase in salinity is expected to result in a gradual loss of food sources and reproductive capacity, and eventual decline in species, even with the current inflows. The timing of the eventual elimination of the Salton Sea fisheries is uncertain because it involves a number of external environmental factors, as well as the adaptation potential of the fish.

Salton Sea salinity is increasing because of high evaporative water loss and continued input of salts from irrigation drainage water. The sea is hypersaline, with a salinity greater than the ocean. The present salinity levels are 44 grams per liter (g/L; equivalent to parts per thousand). Tilapia are the most abundant fish in the Salton Sea and are the primary prey of piscivorous birds. The salinity tolerance of tilapia is key to predicting the potential impacts of IID's water conservation actions on the California brown pelican and other piscivorous birds.

Tilapia have been collected at a salinity level of 120 ppt, but reproduction has not been reported at this salinity level (Whitfield and Blaber, 1979). Costa-Pierce and Riedel provide a review of reported salinity tolerances of tilapia. Highest growth rates were reported at 14 ppt, but growth was still good and tilapia reproduced at 30 ppt. At 69 ppt, tilapia grew poorly, but reproduced well. In the Salton Sea at about 44 ppt, tilapia also grew poorly, but reproduced well. Based on these studies, Costa-Pierce and Riedel suggested that tilapia in the Salton Sea could successfully acclimate to and continue to reproduce at a salinity level of 60 ppt. In areas with higher salinity, growth, survival, and reproduction would be expected to decline (Costa-Pierce, personal communication, January 12, 2001).

Selenium

Soil derived from parent rocks containing high amounts of selenium is found throughout much of the West (Seiler et al., 1999; Skorupa, 1998). Selenium enters soils, groundwater, and surface waters through irrigation of selenium-bearing soils, selenium-bearing sediments brought in through local drainages, or water imported for irrigation. Selenium enters the Imperial Valley through Colorado River water brought in for irrigation; its ultimate source is upstream from Parker Dam (Engberg, 1992). Selenium is concentrated in irrigated soils through evapotranspiration and flushed into water sources through irrigation practices (Ohlendorf and Skorupa, 1989; and Seiler et al., 1999). The primary source of selenium in surface drains is from subsurface drainage discharges from sumps and tile drains (Setmire et al., 1996); subsequently, it is discharged into rivers and the Salton Sea.

Selenium is essential in trace amounts for both plants and animals but toxic at higher concentrations (Rosenfeld and Beath, 1946). At excessive levels, selenium can cause adverse impacts in mammalian reproduction, but it is especially toxic to egg-laying organisms, including birds and fish. Reproductive impairment is generally a more sensitive response variable than adult mortality. Selenium bioaccumulates readily in invertebrates (typically 1,000 times the waterborne concentration) and fish; hence, fish and birds that feed on aquatic organisms are most at risk for showing adverse impacts (Eisler, 2000).

Selenium concentrations were measured from Imperial Valley and Salton Sea in a number of different studies. These include broad-based studies of selenium in water, sediment, and biotic samples (Setmire et al., 1990; Setmire et al., 1993; and Rasmussen, 1997) to more focused surveys looking at concentrations in tissues of specific fish or bird species (Ohlendorf and Marois, 1990; Bruehler and de Peyster, 1999; and Audet et al., 1997). Early sampling (Rasmussen, 1988) identified levels of selenium higher in Salton Sea fish than those occurring in the New and Alamo Rivers, reflecting the primary source of bioaccumulation of selenium from benthic food sources of the Salton Sea.

Selenium concentrations found in most invertebrates were generally below 5 μg/g dry weight (DW), which has been recommended as a dietary threshold to avoid adverse impacts in fish and birds that prey on invertebrates (Setmire et al., 1993). This finding indicates that selenium in invertebrates at the Salton Sea are unlikely to cause toxicity to predators feeding on invertebrates. However, some of the pileworms analyzed did exceed 5 μg/g DW, with concentrations ranging from 0.8 to 12.1 μg/g DW.

Several species of aquatic birds or eggs were also sampled (Setmire et al., 1993). Selenium exposure and potential impacts in birds can be assessed most directly through the selenium concentrations in eggs (Skorupa and Ohlendorf, 1991). In the detailed study, Black-necked Stilts were the only species for which eggs were sampled. Stilt eggs had geometric mean concentrations of 6.2 μg/g or less at all locations. Based on Lemly (1996), the geometric mean indicates that risks are low to none for reproductive impairment in Black-necked Stilts, though the range of concentrations likely exceeds 6.2 μg/g and could result in some reproductive impairment. In fact, Bennett (1998) conducted a study that evaluated nesting proficiency in comparison to egg selenium concentrations, and the results indicated that the species is likely experiencing a low level of selenium-induced reproductive depression at the Salton Sea.

CHAPTER 3

Environmental Baseline: Species Accounts and Habitat Status

3.1 Desert Pupfish (*Cyprinodon macularius*)

There are currently two recognized subspecies of desert pupfish: *Cyprinodon macularius macularius* and *C. m. eremus*. Both subspecies are federally listed as endangered. Only the *macularius* subspecies occurs in the Proposed Action area. Historically, *C. m. macularius* occurred in the Gila River basin, mainstream Colorado River from Needles to the Gulf of California, Rio Sonoyta, Puerto Peñasco, and Laguna Salada (Minckley, 1973 and 1980; Miller and Fuiman, 1987). Currently, in California, the *macularius* subspecies is restricted to San Felipe Creek and the adjacent wetland, San Sebastian Marsh, upper Salt Creek, and a small portion of the Salton Sea and adjacent drains (Miller and Fuiman, 1987). *C. m. eremus* was historically found only in Quitobaquito Spring, Arizona. Reintroduction of *C. m. macularius* (15 populations) and *C. m. eremus* (6 populations) has occurred at many different locales in Arizona. Pupfish are also thought to inhabit the Rio Sonoyta and Santa Clara Slough in Sonora, Mexico (Service, 1986).

3.1.1 Life History and Habitat Requirements

Desert pupfish use a variety of different habitats, including cienegas, springs, headwater streams, and margins of large rivers. Desert pupfish prefer shallow, clear water, with either rooted or unattached aquatic plants, restricted surface flow, and sand-silt substrates (Black, 1980; Marsh and Sada, 1993; and Schoenherr, 1990). They have the ability to withstand extreme water temperatures up to 45°C (113°F), dissolved oxygen concentrations down to 0.1 to 0.4 ppm (Service, 1986), and salinity twice that of seawater (68 ppt, Lowe et al., 1967). Barlow (1958) reported that adult desert pupfish survived salinity as high as 98,100 mg/L in the laboratory. They can also survive 10 to 15 ppt changes in salinity as well as daily temperature fluctuations of 22 to 26°C (Kinne, 1960; Lowe and Heath, 1969). In less harsh environments where a greater diversity of fishes are found, pupfish tend to occupy water shallower than that inhabited by adults of most other species (Marsh and Sada, 1993).

Desert pupfish are omnivorous and consume a variety of algae, plants, insects, and crustaceans (Service, 1993; Cox, 1972; and Naiman, 1979). Walters and Legner (1980) found that pupfish foraged mostly on the bottom, consuming midge larvae, detritus, aquatic vegetation, and snails. The desert pupfish is an opportunistic feeder whose diet varies seasonally with food availability (Naiman, 1979). In general, when invertebrates are available, they are the preferred food of foraging pupfish. In the Salton Sea, ostracods, copepods, and, occasionally, insects and pile worms are taken (Moyle, 1976). As invertebrates become less available, pupfish adjust their feeding behavior, and their gut usually contains large amounts of algae and detritus, as well as invertebrates (Cox, 1972).

Desert pupfish have a short life span, usually only 2 years, but they mature rapidly and can reproduce as many as three times during the year. Spawning at the Salton Sea takes place between late March and late September, when water temperatures exceed 20° C, (Moyle, 1976; UCLA, 1983). Adult male desert pupfish are very territorial during the spawning season such that schools consist either entirely of adult females or entirely of juveniles. Desert pupfish usually set up territories in water less than 1 meter (3 feet) deep and associated with structure (Barlow, 1961). Territoriality is highest in locations with large amounts of habitat, high productivity, high population densities, and limited spawning substrate (Service, 1993). Desert pupfish prefer water 18 to 22 centimeters (cm) deep for egg deposition (Courtois and Hino, 1979). Depending on size, a female pupfish may lay 50 to 800 eggs or more during a season (Crear and Haydock, 1971). The eggs hatch in 10 days at 20°C, and the larvae start feeding on small invertebrates within a day after hatching (Crear and Haydock, 1971). Larvae are frequently found in shallow water, where environmental conditions are severe.

3.1.2 Population Status and Threats

Desert Pupfish were listed as Endangered on March 31, 1986. Desert pupfish were abundant along the shore of the Salton Sea through the 1950s (Barlow, 1961). During the 1960s, the numbers declined; by 1978, they were noted as scarce and sporadic (Black, 1980). Dunham and Minckley (1998) reported a rebound of pupfish populations in the Salton Sea paralleling recent declines in non-native fishes, presumably in response to increasing salinity. However, surveys in the various habitats around the Salton Sea indicate a general decline in desert pupfish abundance and distribution since 1991. In 1991, 41 irrigation drains contained pupfish; this number fell to 33 in 1993 (Remington and Hess, 1993). Only 11 irrigation drains contained pupfish in 1998, and the numbers of desert pupfish also declined from earlier surveys (Sutton, 1999).

Declines are thought to have resulted from the introduction and establishment of several exotic tropical species in the Salton Sea (Bolster, 1990; Black, 1980). These introduced species prey on or compete with desert pupfish for food and space. The sailfin molly (*Poecilia latipinna*) was discovered in irrigation drains in the late 1950s (Black, 1980) and has become established in the Salton Sea (Moyle, 1976). The Mozambique mouthbrooder (*Tilapia mossambicus*) and Zill's cichlid (*T. zillii*) were introduced to the Salton Sea in the late 1960s and early 1970s to control aquatic weed growth in the irrigation canals and drains (Black, 1980). Interactions with the introduced mosquitofish (*Gambusia affinis*) have contributed to the decline of pupfish (Evermann, 1930; Jennings, 1985).

Other factors responsible for declines in desert pupfish populations around the Salton Sea include habitat modification due to water diversions and groundwater pumping for agriculture (Pister, 1974; Black, 1980). There is also concern that introduced saltcedar (tamarisk) near pupfish habitat may cause a lack of water at critical times due to evapotranspiration (Marsh and Sada, 1993). Aerial pesticide application is a common practice around the Salton Sea that may also impact populations (Marsh and Sada, 1993).

3.1.3 Habitat and Occurrence in the Proposed Action Area

Desert pupfish prefer backwater areas, springs, streams, and pools along the shoreline of the Salton Sea. Desert pupfish habitat occurs in pools formed by barnacle bars located in near-shore and shoreline areas of the Salton Sea and in Salt Creek. Barnacle bars are deposits of barnacle shells on beaches, near the shore, and at the mouths of drains that discharge to the Salton Sea. The bars form pools that provide habitat for desert pupfish (IID, 1994).

Habitat for desert pupfish also occurs in the mouths of drains discharging directly to the Salton Sea and in the desert washes at San Felipe Creek and Salt Creek. Designated critical habitat for desert pupfish includes San Felipe Creek, Carrizo Wash, and Fish Creek in Imperial County, California (Service, 1986).

Historical accounts indicate that desert pupfish were once widespread and abundant around the Salton Sea. Surveys conducted by the Service to determine their distribution around the Salton Sea indicated that desert pupfish were present in more than 50 localities in canals and shoreline pools on the southern and eastern margins of the Salton Sea (Lau and Boehm, 1991) and in small pools in San Felipe Creek, Carrizo Wash, and Fish Creek Wash near the Salton Sea. Localities also include agricultural drains in the Imperial and Coachella Valleys, shoreline pools around the Salton Sea, the mouth of Salt Creek in Riverside County, lower San Felipe Creek and its associated wetlands in Imperial County, and eight artificial refuge ponds (Bolster, 1990; Service, 1999).

Based on the trapping studies conducted to date, desert pupfish populations are known or expected in drains directly discharging to the Salton Sea, in shoreline pools, and in desert washes at San Felipe Wash and Salt Creek. Desert pupfish are not known nor expected to occur in the New or Alamo Rivers, because of the high sediment loads, excessive velocities, and presence of predators.

Sutton (2000) observed desert pupfish movement between the Salton Sea and nearby drains. Pupfish were moving from both irrigation drains and Salt Creek downstream into shoreline pools. The reverse movement from shoreline pools upstream into both drains and Salt Creek was also observed. Decreases in the size of shoreline pools during seasonal fluctuations in water levels may impact fish health and/or force pupfish to seek other habitat. Thus, the connectivity between habitat types may be necessary to prevent pupfish from becoming stranded in habitats that cannot sustain them for prolonged periods (Sutton, 2000). These observations indicate the importance of agricultural drains as pupfish habitat and the potential for pupfish to use shoreline aquatic habitats as corridors. This potential movement may be important in providing genetic mixing between various populations.

3.2 Razorback Sucker (*Xyrauchen texanus*)

3.2.1 Life History and Habitat Requirements

Adult razorback sucker habitat utilization can vary, depending on season and location. Adult razorback sucker are adapted for swimming in swift currents, but they may also be found in eddies and backwaters away from the main current (Allan and Roden, 1978). Ryden and Pfeifer (1995) observe that subadult razorback sucker use eddies, pools, backwaters, and other slow water habitats during spring runoff and move into swifter habitats associated with the main channel during summer. Tyus and Karp (1990) report that during spring runoff, adults also use flooded lowlands and areas of low velocity. Tyus (1987) indicates that mid-channel sandbars represent a common summer habitat. Bradford et al. (1998) conclude that adult razorback sucker in the lower Imperial Division area of the Colorado River actively selected backwater habitats for use; however, many of these habitats had become unavailable to fish due to the impacts of regulated flows. In clear reservoirs, adults of this species are considered pelagic and can be found at various depths, except during the spawning period when they use more shallow shoreline areas. Little is known about juvenile habitat requirements, because very few juveniles have been captured in the wild. Larval razorback sucker have been observed using nearshore areas in Lake Mohave (Marsh and Langhorst, 1988). In riverine environments, young razorback sucker use shorelines, embayments, and tributary mouths (Minckley et al., 1991).

During the spawning season, adult razorback sucker migrations have been documented in Lake Mohave (Marsh and Minckley, 1989), the Green River, and the lower Yampa River (Tyus, 1987). Razorback sucker adults have demonstrated fidelity for spawning locations (Tyus and Karp, 1990). Spawning in lakes and streams takes place over loosely packed gravel or cobble substrate, and always at velocities less than 1.5 meters/second (4.9 feet/second) (Bradford and Vlach, 1995). In the lower basin reservoirs, spawning occurs from January through April/May (Langhorst and Marsh, 1986). In Lake Mead, spawning has been observed from mid-February until early May (Holden et al., 1997). In the upper basin, spawning occurs later in the year, but the temperature range is similar to lower basin spawning times (Service, 1997b). The final thermal preference for the adult razorback sucker is estimated to lie between 22.9°C and 24.8°C (73.2°F and 76.6°F) (Bulkley and Pimental, 1983).

The razorback sucker is an omnivorous bottom feeder. Its diet is dependent on location and life stage (Bradford and Vlach, 1995; Valdez and Carothers, 1998). Larval razorback sucker were reported to feed on diatoms, rotifers, algae, and detritus (Wydoski and Wick, 1998). Stomach contents of adult individuals collected in riverine habitat consist of algae and dipteran larvae, while adults examined from Lake Mohave were found to feed primarily on planktonic crustaceans (Minckley, 1973).

3.2.2 Population Status and Threats

The razorback sucker was listed as endangered on November 22, 1991. Critical habitat was designated on March 21, 1994. The razorback sucker is an endemic fish of the large rivers in the Colorado River Basin, once being extremely abundant and wide spread. It now occurs in remnant populations in only a few river and reservoir reaches. The largest extant population (over 10,000 adults) occurs in Lake Mohave, Arizona-Nevada, and the largest riverine population (less than 500 adults) occurs in the Green and Yampa Rivers, near Vernal, Utah. The Recovery Plan for razorback sucker was finalized December 23, 1998. Specific recovery goals for down listing and de-listing were proposed in 2001, but have not yet been finalized.

The Lake Mohave population was estimated to contain 60,000 individuals in 1988 (Minckley et al., 1991), but by 1995, only 25,000 razorback suckers were thought to exist there (Marsh, 1995). As of December 2001, over 56,000 young razorback suckers have peen repatriated to Lake Mohave. The population of the older fish has declined to below 4,000 adults. The population of new adults is expected to be over 10,000 fish and growing. Currently, over 110,000 young suckers remain in captivity or are at some point in the rearing and repatriation process.

Combined data from 1990 to 1997 suggest the total population of razorback sucker in Lake Mead during 1997 was between 400 and 450 individuals (Holden et al., 1997). Recent population estimates from 1998 indicate this population may have decreased to less than 300 fish (Holden et al., 1999). Successful spawning has been identified at two locations in Lake Mead. Thousands of larvae were collected during the spring of 1997, but no juveniles were found during May and June of the same year (Holden et al., 1997). The occurrence of some relatively young razorback sucker in recent surveys indicates there may be some recruitment in Lake Mead.

In the upper basin, razorback sucker populations are smaller and more widely distributed. The largest concentration occurs in the middle Green River, but Modde et al. (1996) report the mean razorback sucker population from 1980 to 1992 in the middle Green River was only 524 individuals.

During the past few decades, the population dynamics of razorback sucker at different locations in the LCR basin have exhibited similar trends. Adult fish were observed in each population; however, juveniles were rare. Although wild populations of razorback sucker had been observed spawning in various locations in the lower basin, recruitment was never successful enough to replenish the adult populations. Eventually, the adult fish die of old age, and populations become reduced or extirpated. The lack of recruitment in these populations is thought to be primarily a result of predation by non-native fish on the early life stages of razorback sucker.

Water resource development and interactions with non-native fish species currently threaten razorback sucker (Pacey and Marsh, 1998). The limiting factors resulting from these two major threats include altered temperature and flow regimes, habitat loss, habitat fragmentation, predation, competition, and an increased risk of disease and parasitism. The primary limiting factor for razorback sucker in the lower basin is probably the direct impact of predation by non-native fish on the early life stages of razorback sucker (Johnson, 1997; Pacey and Marsh, 1998).

3.2.3 Habitat and Occurrence in the Proposed Action Area

Razorback sucker are associated with large river systems and, within those systems, prefer low-velocity backwater areas. The high-water velocities and sparse vegetation associated with the irrigation canals in Imperial Valley do not provide these conditions, and habitat quality is low for razorback sucker.

Small numbers of razorback sucker have been found during canal and reservoir dewaterings in the Imperial Valley over the years. Razorback sucker are known to occur in the All American and East Highline Canal systems. The species has also been found in an IID reservoir near Niland. The population in Imperial County is believed to be composed of old members of a dwindling, nonreproductive, remnant stock (Tyus, 1991; Minckley et al., 1991). No recruitment of wild-spawned fish occurs, probably because of predation by introduced fishes and poor habitat conditions (Tyus, 1991). While it is possible that adult razorback sucker entrained in the canal system persist for some time, they are not likely to establish a self-sustaining population.

3.3 Yuma Clapper Rail (*Rallus longirostris yumanensis*)

The Yuma Clapper Rail is one of seven North American subspecies of clapper rails. It occurs primarily in the LCR Valley in California, Arizona, and Mexico and is a fairly common summer resident from Topock south to Yuma in the United States, and at the Colorado River Delta in Mexico. There are also populations of this subspecies at the Salton Sea in California and along the Gila and Salt Rivers to Picacho Reservoir and Blue Point in central Arizona (Rosenberg et al., 1991). In recent years, individual clapper rails have been heard at Laughlin Bay and Las Vegas Wash in southern Nevada (NDOW, 1998). Population centers for this subspecies include Imperial Wildlife Management Area (Wister Unit), Salton Sea National Wildlife Refuge, Imperial Division, Imperial National Wildlife Refuge, Cibola National Wildlife Refuge, Mittry Lake, West Pond, Bill Williams Delta, Topock Gorge, and Topock Marsh.

3.3.1 Life History and Habitat Requirements

The Yuma Clapper Rail is associated primarily with freshwater marshes, with the highest densities of this subspecies occurring in mature stands of dense to moderately dense cattails and bulrushes. Dense common reed and sparse cattail-bulrush marshes may support the rail at lower densities (Rosenberg et al., 1991). A mosaic of uneven-aged marsh vegetation and open water areas of variable depths appear to provide optimal habitat for the Yuma Clapper Rail (Conway et al., 1993). Similarly, Anderson (1983) found the highest densities of clapper rails in stands of cattails dissected by narrow channels of flowing water.

Food primarily consists of crayfish, an introduced species, but they will also feed on small fish, isopods, insects, spiders, freshwater shrimp, clams, and seeds when available (Ohmart and Tomlinson, 1977; CDFG, 1991; and Rosenberg et al., 1991). Crayfish have been found to constitute up to 95 percent of the diet of Yuma Clapper Rails in some locations (Ohmart and Tomlinson, 1977). The availability of crayfish has been suggested as a factor limiting rail populations (Rosenberg et al., 1991).

Yuma Clapper Rails begin courtship and pairing behavior as early as February, with nesting and incubation beginning as early as mid-March. Most nesting starts between late April and late May (Eddleman, 1989; Conway et al., 1993). Young hatch in the first week of June and suffer high mortality from predators in their first month of life (Rosenberg et al., 1991). The majority of rail chicks fledge by August.

Nests are constructed on dry hummock or under dead emergent vegetation and at the bases of cattail/bulrush vegetation. Nests may be located throughout a marsh over shallow or deep water, near the marsh edge, or in the interior of the marsh (Eddleman, 1989). Usually, nests have no overhead canopy because the dense marsh vegetation surrounding the nest provides protective cover. Occasionally, nests are located in small shrubs over shallow water areas.

3.3.2 Population Status and Threats

The Yuma Clapper Rail was listed as endangered on March 11, 1967. Anecdotal accounts of perceived habitat limitations and limited population numbers were the basis of this early listing (U.S. Fish and Wildlife Service 1983; Eddleman 1989). At the time the recovery plan was finalized in 1983, surveys had shown that the Yuma Clapper Rail population was relatively stable. The recovery team estimated approximately 1,700 breeding birds range-wide, with a U.S. population of approximately 700 birds from 1969 through the publication of the recovery plan in 1983 (U.S. Fish and Wildlife Service 1983).

In 1985, Anderson and Ohmart (1985) estimated a population size of 750 birds along the Colorado River north of the international boundary. Anderson (1983) estimated a total of

1,700 to 2,000 individuals throughout the range of the subspecies. Between 1990 and 1999, call counts conducted throughout the United States have recorded 600 to 1,000 individuals. These counts are only estimates of the minimum number of birds present. The population is probably higher than these counts show, since up to 40 percent of the birds may not respond in call surveys (Piest and Campoy, 1998). Based on the call count surveys, the U.S. population of Yuma Clapper Rail appears stable (Service, unpublished data). The range of the Yuma Clapper Rail has been expanding over the past 25 years, and the population may increase (Ohmart and Smith, 1973; Monson and Phillips, 1981; Rosenberg et al., 1991; and McKernan and Braden, 1999).

A substantial population of Yuma Clapper Rail exists proximate to the Colorado River in Mexico. Eddleman (1989) estimated a total of 450 to 970 Yuma Clapper Rails were present there in 1987. The birds were located in the Cienega de Santa Clara, Sonora, Mexico (200-400 birds), along a dike road on the delta proper (35-140 birds), and at the confluence of the Rio Hardy and Colorado River (200-400 birds). Current estimates of Yuma Clapper Rail in Mexico were made in 1999 (Hinojosa-Huerta, et al., 2000). These indicate over 6,000 Yuma Clapper Rail occur in Mexico, with the majority of the population (6,294) occurring in the Cienega de Santa Clara. Other Yuma Clapper Rail were detected at Laguna del Indio, the eastern drains at Ayala-Aacatecas, Rio El Mayor, the Cupapa Wetland Complex at the confluence of the Rio Hardy and Colorado River, and along the Rio Hardy. Interestingly enough, no Yuma Clapper Rail were detected along the riparian corridor of the Colorado River in Mexico (Hinojosa-Huerta, et. al. 2000).

The Yuma Clapper Rail is threatened by river management activities that are detrimental to marsh formation, such as dredging, channelization, bank stabilization, and other flood control measures. Another threat is environmental contamination due to selenium. High selenium levels have been documented in crayfish, a primary prey of rails, and some adult birds and eggs. Other threats to the Yuma Clapper Rail include mosquito abatement activities, agricultural activities, development, and the displacement of native habitats by exotic vegetation (CDFG, 1991).

3.3.3 Habitat and Occurrence in the Proposed Action Area

In the Proposed Action area, habitat for Yuma Clapper Rail consists mainly of managed wetlands on the state and federal wildlife refuges. Yuma Clapper Rails will use agricultural drains dominated by common reed for foraging, but these areas do not provide suitable nesting habitat. Clapper rails are strongly associated with cattail stands for nesting, and few areas of cattails exist along agricultural drains and the New and Alamo Rivers. Areas of cattails that do exist along these waterways are small and narrow and often interspersed with vegetation, such as common reed and offer suboptimal habitat conditions.

The principal concentrations of Yuma Clapper Rails are at the south end of the Salton Sea near the New and Alamo River mouths, at the Salton Sea Wildlife Refuge, at the Wister Waterfowl Management Area, and at Finney Lake in the Imperial Wildlife Area. Since 1990, an average of 365 ± 106 rails have been counted around the Salton Sea, which represents an estimated 40 percent of the entire U.S. population of this species (Point Reyes Bird Observatory, 1999; Service, 1999). Rails are also known to occur in the seepage community along the AAC between Drops 3 and 4 and in other seepage areas associated with the

Coachella and East Highline Canals (Gould, 1975; Jurek, 1975; Bennett and Ohmart, 1978; Kasprzyk et al., 1987; Reclamation and IID, 1994).

Yuma Clapper Rails have also been found using agricultural drains and the Alamo River. Surveys conducted by the Service (Steve Johnson, personal communication) found Yuma Clapper Rail in the Trifolium 1 drain and the Alamo River. Hurlbert et al. (1997) surveyed 10 drains in the Imperial Valley and found 1 clapper rail along the Holtville Main Drain in the southeastern part of the valley. Previous surveys by the Service of the Holtville Main Drain reported as many as 12 Yuma Clapper Rails (5 pairs and 2 individuals) using this drain.

3.4 Mountain Plover (*Charadrius montanus*)

The Mountain Plover formerly bred throughout the dry prairies of the western Great Plains from Montana to New Mexico and Texas. Nearly half the remaining breeding population in now found in Colorado and Montana. Approximately 90 percent of Mountain Plovers spend the winter in California, primarily in the Central Valley from Sacramento south to Bakersfield and west of Highway 99, and the Imperial Valley. Mountain Plovers are also seen during the winter in Arizona, Texas, and Mexico.

3.4.1 Life History and Habitat Requirements

The Mountain Plover is endemic to the short-grass prairie and shrub-steppe landscape. They nest primarily on shortgrass prairie and grazed grassland. In winter, they occur in flocks of 15 to several hundred individuals, feeding on desert flats, alkaline flats, grazed pastures, plowed ground, and sprouting grain fields (Knopf, 1996; Hayman et al., 1986; Kaufmann, 1996; Terres, 1980). Mountain Plovers eat mostly insects, including grasshoppers, beetles, flies, and crickets (Kaufmann, 1996). A sample of six plover stomachs contained beetles and larva, weevils, earwigs, and maggots (Rosenberg et al., 1991). On their wintering grounds, Mountain Plovers have been successfully attracted to burned grasslands for use as night roost sites (Knopf, 1996).

In general, Mountain Plovers spend about 4 months of the year on their breeding grounds, 5 months on wintering habitat, and the remaining time mostly in their fall migration. Mountain Plovers arrive on their breeding grounds in Colorado and Montana by late March and occupy the breeding range from about April 1 to August 1. They depart for their wintering grounds in California, Texas, Arizona, and Mexico between August and October. Mountain Plovers begin to arrive on wintering grounds in California by September, but do not appear in large numbers until November.

3.4.2 Population Status and Threats

The Mountain Plover was listed as proposed threatened on February 16, 1999. Although once abundant throughout its range, the Mountain Plover is believed to have suffered a 61 percent population decrease between 1966 and 1987. Mountain Plovers have disappeared from much of their former breeding range because of agricultural conversion of former shortgrass prairie. Populations of this species now appear to be relatively small and highly restricted in a patchy distribution. In 1995, the North American population of this species was estimated at 8,000 to 10,000 birds (Knopf, 1996). The decline of the Mountain Plover is primarily attributed to human-related disturbances on breeding grounds, including the loss of native habitat to agriculture and urbanization, hunting, range management, gas and oil development, mining, prairie dog control, environmental contamination, and vehicle disturbance (Leachman and Osmundson, 1990; Knopf, 1996). Habitat loss remains the primary threat to this species.

3.4.3 Habitat and Occurrence in the Proposed Action Area

In the Imperial Valley, wintering flocks of Mountain Plovers frequent bare plowed agricultural fields that have not been irrigated. Bermuda grass crops are also used (Reclamation and IID, 1994). Mountain Plovers are common winter visitors to the Salton Sea Basin. The Imperial Valley has one of the Mountain Plover's largest wintering populations in the Pacific Flyway, with between 700 and 1,000 individuals (Service, 1999). During February 1999 surveys, 2,486 individuals were counted in the valley. This number represents about half the California population and about one-quarter of the North American population (Point Reyes Bird Observatory, 1999).

3.5 Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

The Southwestern Willow Flycatcher is recognized as one of five subspecies of the willow flycatcher. Southwestern Willow Flycatchers were once widespread and locally common throughout the southwest, and were distributed across southern California, southern Nevada, southern Utah, Arizona, New Mexico, and western Texas (Hubbard, 1987; Unitt, 1987; Browning, 1993). Recent trends indicate a marked decrease in populations along the full breeding range of the species (Service 2001). In January 1992, the Service was petitioned to list the Southwestern Willow Flycatcher, empidonax Trailii extimus as an endangered species. In July 1993, the species was proposed as endangered with critical habitat (58 FR 39495). On February 27, 2995, the species was listed as endangered (60 FR 10694). Recent estimates indicate a population of approximately 900-1100 pairs (Service, 2001).

Large breeding populations of Southwestern Willow Flycatcher in California occur along the San Luis Rey and Santa Margarita Rivers in San Diego County and along the south fork of the Kern River at the southwest end of the Sierra Nevada Mountains (Salton Sea Authority and Reclamation, 2000). Large numbers of flycatchers pass through Southern California deserts during spring and fall migration (Garrett and Dunn, 1981). Breeding populations also occur along the Lower Colorado River, mainly near Needles, California, in the Virgin River, in the Grand Canyon and at Pahranagat National Wildlife Refuge in Nevada (McKernan and Braden, 2002).

3.5.1 Life History and Habitat Requirements

The Southwestern Willow Flycatcher is a neotropical migrant that is strongly associated with riparian habitats. It is considered a partial obligate on cottonwood-willow riparian systems throughout southwestern riverine systems. Its association with cottonwood-willow habitats is strongest at low elevations (Hunter et al., 1987).

Breeding habitat consists of dense stands of intermediate-size shrubs or trees, such as willow, Coyote bush, ash, boxelder, and alder, with an overstory of larger trees, such as cottonwood. Exotic species, such as Russian olive and tamarisk may be present. Both even-and uneven-age sites are utilized by this subspecies for nesting habitat. Typically, nesting habitat for the willow flycatcher has extensive canopy coverage and is structurally homogenous (Service, 1995a). Occupied habitat is generally associated with surface water or saturated soil and dominated by shrubs and trees 10 to 30 feet tall that provide dense lower and mid-story vegetation, with small twigs and branches for nesting (Sogge et al., 1997). For riparian habitat, this corresponds to cottonwood-willow structural types I, II, III, and IV and tamarisk structural types III and IV using the classification system of Anderson and Ohmart (1994). The dense structure of the vegetation and the presence of either standing water, moist soil, or water adjacent to the site are two characteristics that are generally consistent throughout the bird's range (Sogge et al., 1997). Apparently, habitat structure and the presence of surface water or saturated soils may be more important than plant species composition in defining suitable flycatcher habitat (Service, 1995a).

The Southwestern Willow Flycatcher is present and singing on its breeding territory by mid-May, and young are fledged by early to mid-July (Service, 1995a). Territory sizes for the subspecies are not well known due to its rarity and variable habitat utilization. However, habitat patches as small as 1.2 acres have been found to support one or two nesting pairs (Service, 1995a).

This species is insectivorous and forages for insects both within and above dense riparian vegetation. Prey items are taken on the wing and gleaned from foliage. This species also forages along water edges, backwaters, and sandbars adjacent to nest sites.

3.5.2 Population Status and Threats

Since the 1800s, the Southwestern Willow Flycatcher has experienced extensive population reductions throughout its range (Service, 1995a; AGFD, 1997). The population of Southwestern Willow Flycatcher in Southern California was estimated at fewer than 80 pairs in the early 1980s (Unitt, 1984). River systems where there are continued populations of flycatchers in California include the Colorado, Owens, Kern, Mojave, Santa Ana, Pilgrim Creek, Santa Margarita, San Luis Rey, San Timeteo Creek, Santa Clara, Santa Ynez, Sweetwater, San Dieguito, and Temecula Creek (Service, 2001). Current numbers of know territories for breeding habitats surveyed between 1993 and 1999 in the above areas is approximately 124 territories (Service, 2001). Surveys conducted since 1996 along the LCR indicate there are approximately 100 - 200 breeding pair from the Virgin River and Pahranagat National Wildlife Refuge to the Southern International border (McKernan and Braden, 1998, 1999, 2001a&b, 2002).

The primary factors responsible for the decline of the Southwestern Willow Flycatcher are the loss and degradation of native riparian habitats, particularly cottonwood-willow associations (Service, 1995a; AGFD, 1997). Related factors contributing to the decline of this species include brood parasitism by brown-headed cowbirds, increased predation, salt cedar invasion, urban and agricultural development, livestock grazing, water diversion and impoundment, channelization, offroad vehicle use and recreation, floods, pesticides, forest practices, and possible gene pool limitations (Service, 1995a; AGFD, 1997). These factors continue to threaten the survival of this species.

3.5.3 Habitat and Occurrence in the Proposed Action Area

Cottonwood-willow habitat is largely absent from the Proposed Action area. Between Drops 3 and 4, seepage from the AAC supports a localized area of cottonwood/willow habitat. Tamarisk also occurs in areas receiving seepage from the AAC and is dominant along the New and Alamo Rivers. Successful nesting has been documented in Tamarisk stands III and IV that are moist beneath or have water present nearby, and there is no data to suggest lower reproductive success in tamarisk versus native habitat types (Pers. comm. William Rinne, Reclamation). Tamarisk and common reed supported along the agricultural drains may be used by migrating flycatchers.

There is little information regarding the occurrence and distribution of the Southwestern Willow Flycatcher in the Proposed Action area. Willow flycatchers of an undetermined subspecies have been reported at the Salton Sea National Wildlife Refuge and are considered an uncommon spring migrant and common fall migrant (Service, 1997a). These birds may include other subspecies of willow flycatchers that migrate through the area between northern breeding areas and wintering grounds in South America. Southwestern Willow Flycatchers have been reported in the Imperial Valley in residential areas near Niland, in riparian and desert scrub habitats, and along agricultural drains. In addition, 10 agricultural drains were surveyed in the Imperial Valley during 1994 to 1995. Single Southwestern Willow Flycatchers were observed along the Holtville Main, Trifolium 2, and Nettle Drains (Hurlbert et al., 1997). Southwestern Willow Flycatchers are also known to use seepage communities along the AAC near the mission wash flume 3 miles north-northeast of Bard. These observations show a low but consistent use of the area by flycatchers during migration. Nesting by this species has not been reported in the Proposed Action area.

3.6 Bald Eagle (*Haliaeetus leucocephalus*)

Bald Eagles occur in North America from central Alaska and Canada south to northern Mexico (Service, 1995b). They are found primarily along coasts, inland lakes, and large rivers, but may also be found along mountain ranges during migration. Although the Bald Eagle is greatly reduced in abundance from historical levels, the current distribution is essentially the same (Service, 1976). Many Bald Eagles withdraw in winter from northern areas, migrating north again in spring and summer to breed (Terres, 1980).

3.6.1 Life History and Habitat Requirements

The Bald Eagle is associated with aquatic ecosystems, including large rivers, major lakes, reservoirs, estuaries, and seacoasts. This species requires open water habitats that support an adequate food base and forages on fish and waterfowl from perch sites adjacent to foraging areas. Thus, perch sites near open water or marshes are an essential habitat feature. Bald Eagles acquire food in a diversity of ways. They catch live prey, steal prey from other predators, and find carrion. Fish, small mammals, and waterfowl make up the majority of eagles' diet (Terres, 1980).

The Bald Eagle breeds from January through July, with peak activity from March to June. The species is monogamous, and both the male and female tend the nests. Broods generally consist of two eggs. Individuals usually nest in the same territories each year and often reuse the same nest. In California, nesting territories for the Bald Eagle are usually found in mixed conifer and ponderosa pine forests and are always associated with a lake, river, or other large body of water. Nests are typically a platform structure constructed in dominant or co-dominant trees within 1 mile of water with unobstructed views of the water body. Snags and dead-topped trees provide perch and roost sites for the nesting birds.

The Bald Eagle winters along rivers, lakes, or reservoirs with abundant prey and adjacent snags or mature trees for perch sites. Mature trees or snags with an open branching structure that are isolated from human disturbance are used for roosting during winter. Bald Eagles often roost communally during the winter. The most important component of Bald Eagle wintering habitat is an adequate food source.

3.6.2 Population Status and Threats

The Bald Eagle was listed as endangered on February 14, 1978, and subsequently reclassified as threatened on August 11, 1995. Historically, the Bald Eagle has nested throughout North America on both coasts and along major rivers and large lakes (Gerrard and Bortolotti, 1988). By the mid-1800s, Bald Eagle populations had declined radically throughout most of the United States because of widespread shooting, reductions in the species' prey base, and secondary poisoning as a result of predator control programs. The introduction of dichlorodiphenyl-trichloroethane (DDT) for agricultural purposes in the 1940s furthered the decline of this species, resulting in widespread reproductive failure due to eggshell thinning. Efforts to save the Bald Eagle, including passage of the Bald Eagle Protection Act in 1940, listing the Bald Eagle as a federally endangered species in 1967, and banning DDT in the United States and Canada in the early 1970s have resulted in a slow recovery of the species. Between 1982 and 1990, the number of occupied Bald Eagle territories in the lower 48 United States doubled from 1,482 to 3,014. Reintroduction programs have also contributed to the species' recovery (Hunt et al., 1992). Due to population increases, the Service has proposed to delist the Bald Eagle (*FR* 64 36454-36464). The main threats to - in the study area are habitat loss and degradation, including declines in prey and roost-site availability. Human disturbance, environmental contamination, electrocution, poisoning, trapping, and illegal taking also threaten this species (NMDGF, 1997).

3.6.3 Habitat and Occurrence in the Proposed Action Area

Suitable foraging habitat occurs at the Salton Sea and adjacent wetlands, where eagles may prey on fish and waterfowl. The state and federal wildlife refuges as well as private duck clubs that support abundant waterfowl populations during the winter may also attract Bald Eagles. In addition, some waterfowl species forage in agricultural fields of the valley, and the Bald Eagle probably exploits this food source where trees are present to provide roost sites.

The Bald Eagle is a rare and occasional winter visitor to the Proposed Action area. A few winter migrants (one to three birds) have been regularly observed at the Salton Sea, but are rarely observed during the fall (IID, 1994). They are not known to breed in the Proposed Action area.

3.7 California Brown Pelican *(Pelecanus occidentalis californicus)*

California Brown Pelicans occur in marine habitats along the Pacific, Atlantic, and Gulf Coasts in North America and range southward through the Gulf and Caribbean areas to

Central and South America. The California subspecies nests on islands off the coast of Southern California, south along the coast of Baja California and the Gulf of California to Guerrero, Mexico (CDFG, 1992). After the breeding season, California Brown Pelicans disperse from breeding areas and can be found as far north as British Columbia, Canada, and as far south as South America.

3.7.1 Life History and Habitat Requirements

California Brown Pelicans are found primarily in warm estuarine, marine subtidal, and marine pelagic waters (Zeiner et al., 1990; NMDGF, 1997). They occur mostly over shallow waters along the immediate coast, especially near beaches and on salt bays (Kaufmann, 1996). Brown pelicans roost on water, rocks, rocky cliffs, jetties, piers, sandy beaches, and mudflats and forage in open water. The California Brown Pelican is a plunge diver, often locating fish from the air and diving into the water to catch them. They feed almost exclusively on fish. The species is a colonial nester and nests on islands in trees, bushes, and on the ground. The California Brown Pelican first breeds at 2 or 3 years of age with only one brood raised per year (Kaufmann, 1996; Terres, 1980; Zeiner et al., 1990). For roosting, pelicans congregate at selected roosting locations that are isolated from human activity.

3.7.2 Population Status and Threats

The California Brown Pelican was listed as endangered on October 13, 1970. California Brown Pelican populations declined greatly in the mid-20th century because of human persecution, disturbance of nesting colonies, and reproductive failure caused by eggshell thinning and the adverse behavioral impacts of pesticides (Palmer, 1962; Terres, 1980). Most North American populations of this species were extirpated by 1970. Since the banning of DDT and other organochlorine pesticide use in the early 1970s, brown pelicans have made a strong recovery and are now fairly common and perhaps still increasing on the southeast and west coasts (Kaufmann, 1996). The endangered Southern California Bight population of the brown pelican grew to 7,200 breeding pairs by 1987 but has experienced considerable population fluctuations in recent years and has not, as yet, been considered sufficiently stable for delisting (CDFG, 1992). In 1992, there were an estimated 6,000 pairs in Southern California and about 45,000 pairs on Mexico's west coast (Ehrlich et al., 1992). Transient brown pelicans are threatened by physical injury or direct mortality resulting from human persecution, fish hooks, or accidental entanglement in fishing lines. Pesticides, poisons, and other environmental contaminants as well as human disturbance and disease may also threaten California Brown Pelicans (CDFG, 1992).

3.7.3 Habitat and Occurrence in the Proposed Action Area

Because California Brown Pelicans are associated with large open waterbodies, habitat for the species in the Proposed Action area principally occurs at the Salton Sea, where abundant fish populations provide foraging opportunities for brown pelicans. Nesting habitat is present at the Alamo River Delta, where brown pelicans have nested since 1996 (Shuford et al., 1999). In addition to the Salton Sea, brown pelicans are known to use Finney Lake in the Imperial Wildlife Area (Corps, 1996).

California Brown Pelicans probably had little historical use of the Salton Sea (Anderson, 1993). Some visiting postbreeding pelicans were documented at the Salton Sea in the late

1970s, but overwintering was not confirmed until 1987. Use of the Salton Sea by California Brown Pelicans subsequently increased. The Salton Sea currently supports a year-round population of California Brown Pelicans, sometimes reaching 5,000 birds, although more typically numbering 1,000 to 2,000 birds. The California Brown Pelican was first found to nest at the Salton Sea in 1996. The number of breeding birds has been low with six pairs nesting in 1996 and several pairs attempting to nest annually since then (Shuford et al., 1999). California Brown Pelicans have not successfully fledged young at the Salton Sea. The nearest breeding colonies are in the Gulf of California on San Luis Island (4,000 to 12,000 pairs), Puerto Refugio (1,000 to 4,000 breeding pairs), and the Salsipuedes/Animas/San Lorenzo area (3,000 to 18,000 pairs). Other breeding populations occur off the southern California Coast and the western coast of Baja California (Johnsgard, 1993).

CHAPTER 4

Impacts of Proposed Action on Habitat and Special Status Species

This Chapter provides a description of the impacts of the proposed action on listed species, including interrelated/interdependent, and cumulative effects. In particular, the water conservation measures to be undertaken by IID are cumulative effects that are the focus of the analysis in this Chapter. The Conservation Plan has been developed, in part, to address and mitigate these cumulative effects.

4.1 Interrelated / Interdependent Actions

Interrelated actions are part of the Proposed Action that depend on the action for their justification, and interdependent actions have no independent utility apart from the Proposed Action. The Conservation Plan that is the proposed action under this consultation has been developed to mitigate IID's water conservation measures proposed under the QSA, but the water transfer project does not depend on the Conservation Plan for its justification. Since the Conservation Plan does not "trigger" other actions, there are no interdependent/interrelated actions to be analyzed.

4.2 Cumulative Effects

Cumulative actions involve future state or private activities, not involving Federal activities, that are reasonably certain to occur in the action area. Projects assessed for their potential to result in cumulative impacts were identified through a review of regional and local environmental documents. Both the type of project and the appropriate geographic scope (i.e., projects that would be located in the same general area as the Proposed Action's geographic subregions), and their incremental impacts, were considered.

The following sections describe the related projects assessed for cumulative impacts when combined with incremental impacts of the Proposed Action. Of particular significance to this analysis is the IID Water Conservation and Transfer Project, which is described in Section 4.2.4.

4.2.1 California's Colorado River Water Use Plan (California Plan)

In an effort to prepare for likely reductions of Colorado River water available to California, the Colorado River Board of California prepared the California Plan, which was released in draft form in May 2000 and is available for public review at www.crb.water.ca.gov/reports.htm. The California Plan provides a framework for the state to coordinate and assist in the cooperative implementation of diverse programs, projects, and other activities that would reduce California's use of Colorado River water and facilitate conformance with California's annual apportionment. It involves the conservation of water in southern California and the transfer of conserved water from agricultural to predominantly urban uses. It also identifies future groundwater conjunctive use projects that would store Colorado River water when available. The proposed QSA, as described in Section 2.5.2, is designed to include key contractual arrangements among IID, MWD, and CVWD, which are needed to implement major components of the California Plan.

Potential impacts to listed species in MWD and SDCWA service areas from their activities related to the QSA and transfer are covered by existing and developing HCPs and other plans and consultations of projects occurring in those service areas.

4.2.2 Quantification Settlement Agreement

The IID, CVWD, and MWD negotiated the terms of the QSA. Although not a signatory to the proposed QSA, SDCWA is a member agency of MWD. SDCWA participated in the QSA negotiations and benefits or is impacted by certain of its terms. The QSA is a consensual reallocation of Colorado River water based on a series of proposed agreements, which include water conservation/transfer and exchange projects among IID, CVWD, and MWD. The proposed QSA provides part of the mechanism for California to reduce its water diversions from the Colorado River in normal years to its apportioned amount of 4.4 MAF under the California Plan. The implementation of the proposed QSA, which includes water conservation and water transfers from agricultural use to principally urban use, would result in a net reduction of Colorado River diversions to California.

If the QSA is fully approved by the participating agencies and if the conditions to implementation of the QSA are satisfied or waived, SDCWA would be limited to the primary amount (130 to 200 KAFY) of transferred water under the IID/SDCWA Transfer Agreement. CVWD would have an option to acquire up to 100 KAFY, and MWD would have an option to acquire any portion of the 100 KAFY that CVWD elects not to acquire. IID, MWD, CVWD, and SDCWA are the co-lead agencies for the preparation, in accord with CEQA, of a *Draft Program EIR for the Implementation of the Colorado River Quantification Settlement Agreement* (Draft QSA PEIR) (CVWD et al., 2002). The federal approvals required to implement water deliveries in accord with the QSA will be evidenced by the Secretary's execution of the IA. The Draft QSA PEIR is a programmatic assessment of environmental impacts of implementation of the QSA by these California water agencies and is intended to provide an overall assessment of the multiple projects included in the QSA. The document is available from MWD, 700 North Alameda Street, Los Angeles, CA 90012.

The QSA includes the allocation of conserved water to be generated by certain projects that have been assessed in final CEQA/NEPA documentation and Section 7 consultations. These projects are outside of the Proposed Action area (Salton Sea and IID Service Area) covered under this BA.

4.2.3 Coachella Valley Water Management Plan

CVWD prepared the Coachella Valley Water Management Plan to provide an overall program for managing its surface and groundwater resources in the future. The objectives of this water management plan are to:

- Eliminate groundwater overdraft and its associated adverse impacts, including groundwater storage reduction, declining groundwater levels, land subsidence, and water quality degradation

- Maximize conjunctive use opportunities
- Minimize adverse economic impacts to Coachella Valley water users
- Minimize environmental impacts

The overall water management plan involves a number of actions to reduce the current overdraft of groundwater in the Coachella Valley through increased use of Colorado River water (reducing demand for groundwater pumping) and various recycling and conservation measures to reuse or decrease the consumption of water. A substantial portion of the additional Colorado River water to be used pursuant to the water management plan (up to 100 KAFY) is the conserved water to be transferred by IID to CVWD under the QSA. Other elements of this plan are not dependent on implementation of the QSA.

4.2.4 Potential IID Water Conservation Actions Resulting from Proposed QSA Water Transfers

Water conservation measures or other water use activities will be implemented by IID, to conserve the water to be delivered pursuant to the QSA. Implementation of water conservation measures would occur gradually, based on schedules defined in the QSA. Water conservation would likely be accomplished through a combination of on-farm and system-based conservation measures. On-farm measures consist of actions taken by individual farmers or landowners to conserve water under voluntary water conservation agreements with IID. System-based conservation measures consist of actions that may be undertaken by IID to conserve water. The exact mix of conservation methods employed may vary over the life of the project and will be determined by IID. The following sections describe the suite of conservation methods that could be implemented by IID to develop water for transfer.

4.2.4.1 On-Farm Water Use and Conservation

The conservation of up to 300 KAFY of water in the IID service area will require changes in current farming practices and may result in substantial capital investments in water conservation equipment and technologies. Farmers may voluntarily enter into agreements with IID, thereby committing to the implementation of conservation measures. These measures would require farmers to make capital investments in various types of water conservation equipment and facilities. In many cases, farmers will be required to obtain financing for construction costs to implement and maintain conservation measures. The farmers' ability to obtain financing will depend on the estimate of the direct and indirect costs of implementing water conservation measures.

Many farmers own land in the IID service area. Some lease their land from third parties, and others lease their land from IID. This BA describes potential impacts from water use activities on land in the IID service area, regardless of who owns the land and who conducts the activities. Water use activities by IID and its farmers include all activities associated with moving water from IID's conveyance system to farm fields, irrigating crops, and draining water from fields into the IID drainage system. The options for conserving water that are available to farmers generally fall into these categories:

- Installation of structural or facility improvements, or conversion to irrigation systems that increase efficiency and reduce water losses

- Irrigation management
- Land use practices

4.2.4.1.1 Installation of Structures/Facilities and Conversion of Irrigation Systems

On-farm water conservation can be achieved through various techniques using existing technology. On-farm conservation measures may include:

- Tailwater return systems
- Cascading tailwater systems
- Level basins
- Shorten furrows and border strip improvements
- Narrow border strips
- Cutbacks
- Laser leveling
- Multi-slope
- Drip irrigation

The techniques for achieving water conservation would be at the discretion of the individual farmer. It is expected that some combination of the techniques listed would be employed. These water conservation techniques are briefly described in Table 1.3-1.

TABLE 4.2.-1
On-Farm Water Conservation Techniques

Conservation Technique	Brief Description
Tailwater return or pump back systems	Pumps surface irrigation tailwater back to the head ditch, reducing both the delivery requirement and the volume of water discharged to the drains. Tailwater is water remaining in the irrigation conveyance system at the end of an irrigated field.
Cascading tailwater systems	Allows the tailwater to cascade by gravity to the head ditch of a lower field adjacent to the tailwater ditch. This can be accomplished by placing drainpipes with drop box inlets through the embankment between the fields just upstream of each head ditch check.
Level basins	Dividing a field into basins, and flooding each basin at a relatively high flow rate.
Shorten furrows and border strip improvements	The distribution uniformity of furrow and border strip irrigation can be improved by shortening the length of irrigation runs, particularly in soils with higher infiltration rates.
Narrow border strips	Narrowing the width of border strips can improve distribution uniformity both along the length of fields by improving the advance time and across the width of fields by increasing the depth of flow.
Cutbacks	Irrigation is initiated with a high flow rate to advance the water down the field as quickly as possible without causing erosion. When the water reaches a predetermined distance down the field, the flow is reduced to minimize tailwater.
Multi-slope	Distribution uniformity can be improved for furrow and border strip irrigation by varying the slope of the field, with the head of the field having a greater slope than the end of the field.

TABLE 4.2.-1
On-Farm Water Conservation Techniques

Conservation Technique	Brief Description
Drip irrigation	Water is run through pipes (with holes in them) either buried or lying slightly above the ground next to the crop. Water slowly drips onto the crop roots and stems. Water can be directed only to the plants that need it, cutting back on tailwater runoff.

4.2.4.1.2 Irrigation Management

Certain farmers may be able to conserve water and cultivate the same acreage through better irrigation management without constructing facilities or changing irrigation methods. Irrigation management refers to controlling the timing and amount of each irrigation application to provide adequate crop water for maximum yield and to achieve adequate soil leaching. On-farm irrigation management will continue to evolve as the science of crop/soil water develops and as farmers understand irrigation management better and increase their practical use of it. As greater demands are put on agricultural areas to conserve more water in California, irrigation water management will become a more important tool for farmers.

4.2.4.1.3 Land Use Practices

Fallowing can be described as the reduction or cessation of certain farmland operations for a specified or indefinite period of time. For this analysis, fallowing is defined as:

- Long-term land retirement (greater than 1 year), whereby crop production ceases indefinitely or during the term of the water conservation and transfer agreements. A cover crop may be maintained during the period of inactivity, or the land may be returned to natural vegetation.
- Rotational fallowing, whereby crop production ceases for 1 calendar year. No water is applied, and no cover crop is grown.
- Single crop fallowing, whereby multiple crops are reduced to a single crop rotation on an annual or longer term basis.

IID's Board of Directors adopted Resolution No. 5-96, stating that IID will not support fallowing programs for purposes of transferring water. However, there is no prohibition of fallowing under the terms of the QSA. Fallowing may be considered a potentially viable method to achieve water conservation in IID's service area.

4.2.4.2 System-Based Water Conservation Activities

As part of IID's water conservation and transfer programs, IID may choose to implement operational and structural improvements to conserve water and enhance water delivery and drainage system capabilities and service. The specific improvements that would be undertaken are uncertain; however, the types of improvements that IID could pursue include the following:

- Installing additional lining in canals and laterals
- Replacing existing canal linings as normal maintenance

- Automating flow control structures
- Installing check gates in the laterals that are automated or manually operated
- Installing nonleak gates
- Installing additional lateral interceptors
- Installing additional pipelines
- Installing additional reservoirs, including small, mid-lateral reservoirs to provide temporary water storage
- Developing water reclamation systems
- Installing pump or gravity-operated seepage recovery systems

4.2.4.2.1 Canal Lining and Piping

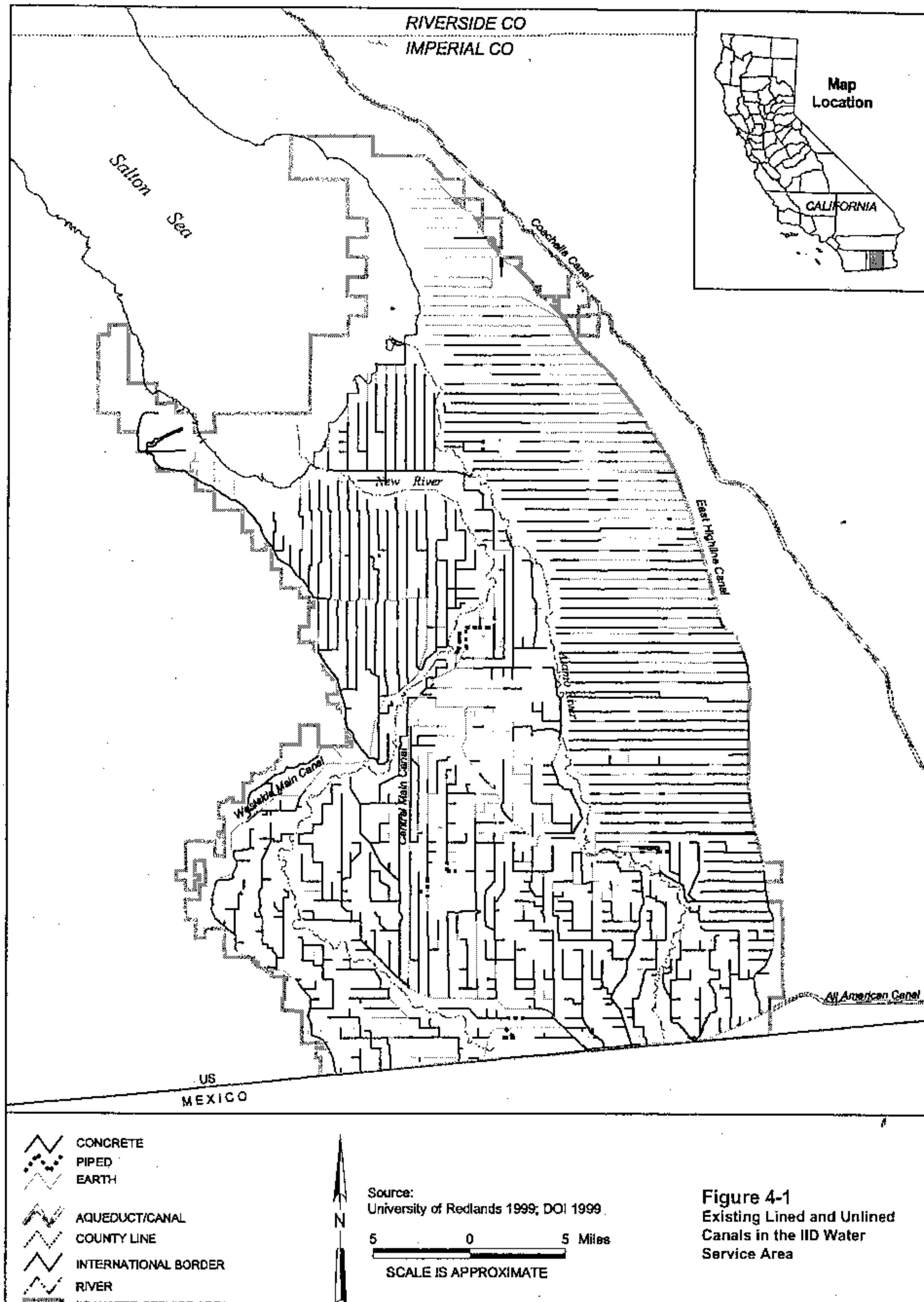
Canal lining consists of lining canals with concrete or using pipelines to reduce seepage. About 537 miles of canals are currently unlined. Existing lined conveyance facilities in the IID water service area are illustrated on Figure 4-1. To line a canal, the existing canal is filled in and then trenched to form a trapezoidal channel. Concrete is then installed on the banks and bottom of the channel using a lining float. Construction activities can be conducted in the canal's right-of-way and impact an area about 70 feet wide centered on the canal. The canal rights-of-way consist of either roads, embankments, or other disturbed ground. About 1 week is required to line a mile of canal. A component of the conservation activities proposed under the IID /SDCWA Transfer Agreement included lining in three canal sections in the IID service area totaling about 1.74 miles (Table 1.3-2).

TABLE 4.2-2
Canals IID Has Considered Lining to Conserve Water and Area Temporarily Disturbed to Line Canals

Canal	Length (miles)	Acreage Impacted
Rose Lateral 9	0.25	2.12
Ash Lateral 43	0.49	4.16
N Lateral	1.00	8.48
Total	**1.74**	**14.76**

4.2.4.2.2 Lateral Interceptors

A lateral interceptor system consists of new canals and reservoirs that collect operational spills from lateral canals. A conceptual lateral interceptor system is illustrated in Figure 4-2. Lateral interceptors are lined canals or pipelines that generally run perpendicular to lateral canals at their terminus. The lateral interceptors capture operational spill water, unused water resulting from canal fluctuations, and return water from farmer delivery reductions or changes. The interceptors convey this captured water to regulating reservoirs, where the water can be stored and reused in another canal serving another delivery system as needed. IID has four systems in operation and potentially could enlarge or expand system capacity in response to a 300 KAFY water shortage.



Source:
University of Redlands 1999; DOI 1999

Figure 4-1
Existing Lined and Unlined Canals in the IID Water Service Area

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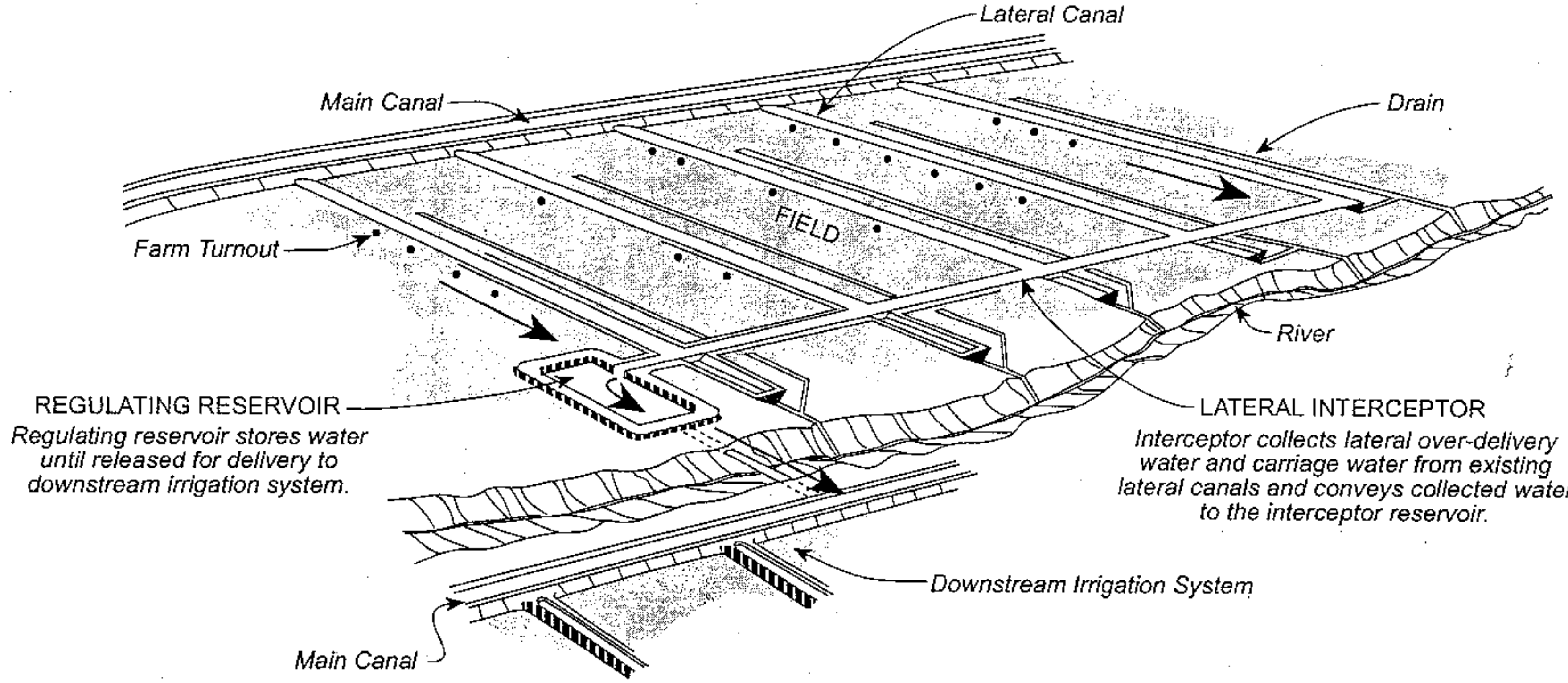

Figure 4-2
Conceptual Lateral Interceptor System

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Installation of a lateral interceptor requires constructing and lining a canal, installing pipelines, and constructing a minimum 40-acre surface reservoir. An approximately 70-foot-wide area centered on the new interceptor would be impacted by the construction. The impacted area of the reservoir site would be only slightly larger than the reservoir itself. A component of the conservation activities proposed under the IID /SDCWA Transfer Agreement included installation of up to 16 lateral interceptors. The total acreage potentially impacted by construction of lateral interceptors could be about 1,480 acres (i.e., approximately 840 acres of canals and 640 acres of reservoir).

4.2.4.2.3 Reservoirs

Two types of reservoirs can facilitate water conservation: operational reservoirs (includes mid-lateral reservoirs) and interceptor reservoirs. Operational reservoirs are generally placed in locations to take advantage of delivery system supply and demand needs and, in some cases, include locations of historical canal spills. These reservoirs are used to regulate canal flows to match or optimize demand flows to supply flows. Conservation is achieved by reducing operational spills as a result of this mismatch of flows by storing excess supply water and then releasing this water in times of shortage demand needs.

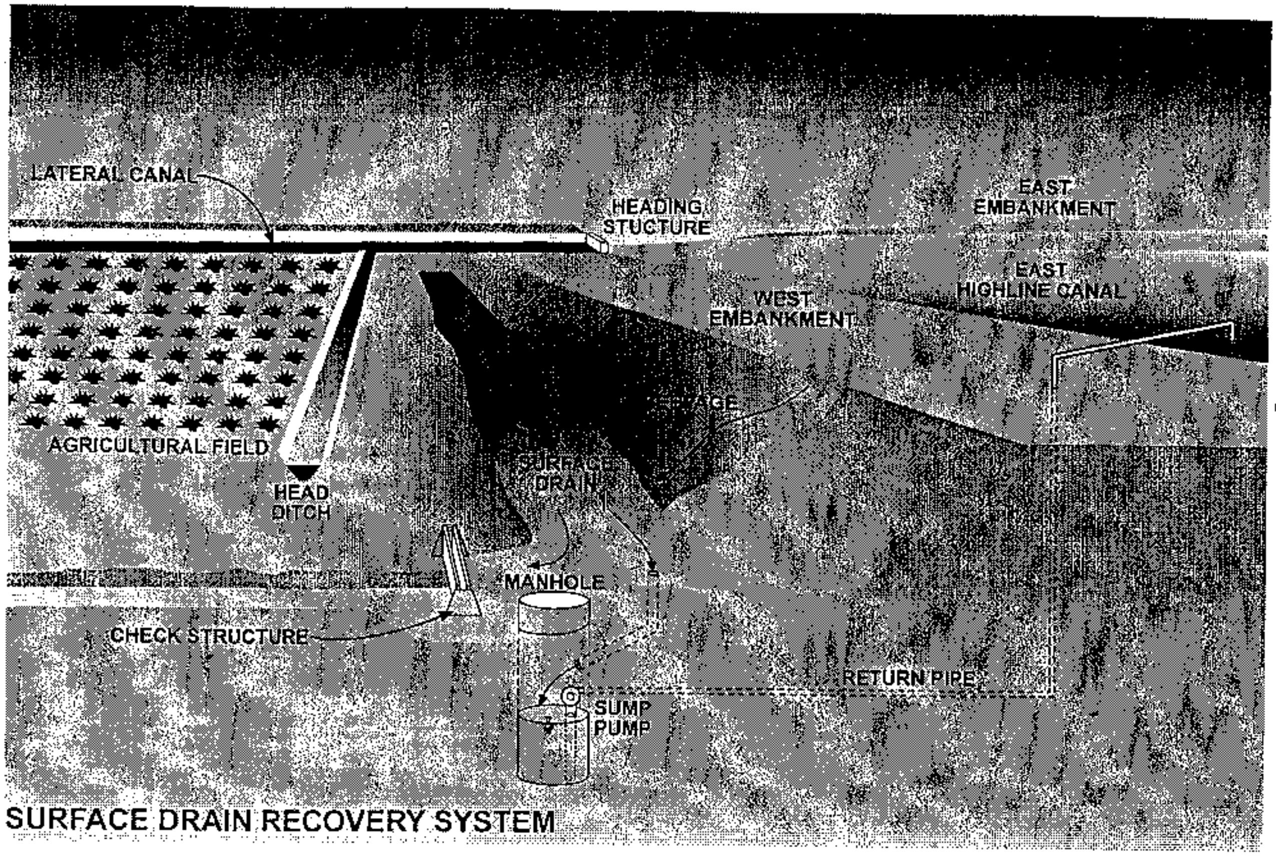
Interceptor reservoirs enhance lateral interceptor system operations. They are typically placed at the end of the lateral interceptor canals to store intercepted flows (operational discharges) for re-regulation rather than losing these flows to the drainage system. These stored flows are later released for use in other delivery system canals to meet water demand. These reservoirs would contain automated inlet and outlet structures that would enable the maintenance of the desired water flow. IID currently does not have any reservoirs in design, but could choose to construct these facilities in response to a 300 KAFY reduction in water delivery. Reservoirs would likely be 1 to 10 acres in size, with a capacity ranging from about 5 to 30 af. For the BA, it is assumed that construction of these reservoirs could encompass up to 1,000 acres.

In addition to reservoirs constructed and operated by IID, farmers in the Imperial Valley may construct small regulating reservoirs to facilitate the conservation of water. These 1- to 2-acre reservoirs would be constructed at the upper end of agricultural fields and used to better regulate irrigation water applied to fields and to settle suspended solids prior to introduction into drip irrigation systems. These reservoirs would contain water only during irrigation operations, remaining dry during the remainder of the year. IID anticipates that these reservoirs could be used on up to 50 percent of the agricultural land in its service area. A single reservoir services about 80 acres of land. Up to about 5,900 acres of agricultural land could be converted to regulating reservoirs.

4.2.4.2.4 Seepage Recovery Systems

To conserve water, IID could install seepage recovery systems adjacent to the East Highline Canal. Surface and subsurface recovery systems conserve water by collecting canal leakage in sumps along a canal and pumping the water back into the same canal. A conceptual seepage recovery system is illustrated on Figure 4-3.

In a surface drain recovery system, seepage is captured and conveyed through open channels to a concrete sump. From there, it is pumped back into the canal. Construction required to install a surface recovery system is minimal. For a surface recovery system, a



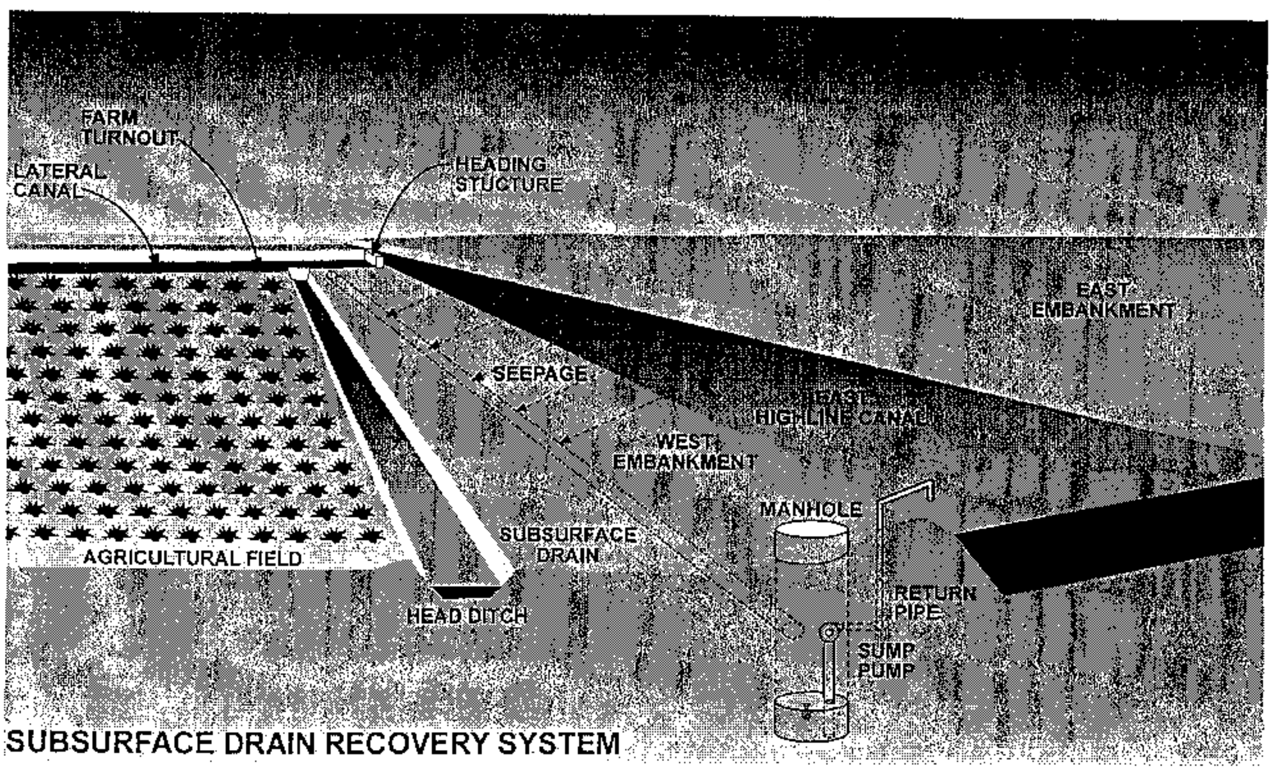


Figure 4-3
Conceptual Seepage Recovery Systems

small check structure would be constructed in the existing parallel drain to pond water to a depth of about 3 feet. A pump station would return water to the East Highline Canal. These systems are appropriate in locations where there is an existing drain that collects seepage and directs water to the drainage system.

In a subsurface recovery system, canal seepage flows are collected in a perforated pipe that directs the water to a concrete sump. From there, it is pumped back into a canal. Subsurface systems are proposed in areas lacking an existing parallel open drain. To install these systems, a trench is excavated, and a pipe is laid in place. The pipeline outlets to a collection well consisting of an 8-foot-diameter vertical pipe from which the water is pumped back to the delivery canal. Construction disturbs an area about 70 feet wide along the pipeline. Following completion of the system, a right-of-way of about 70 feet along the pipeline would need to be free of deep-rooted vegetation.

4.3 Species Analysis

4.3.1 Desert Pupfish

Desert pupfish inhabit drains that discharge directly to the Salton Sea. Water conservation by IID is predicted to reduce flow levels in drains in the IID water service area that discharge directly to the Sea. With conservation of 300 KAFY through on-farm irrigation-system and water delivery system improvements, flows in the drains that discharge directly to the sea from the IID water service area would be reduced by 39 percent, relative to current conditions. If all fallowing is used to conserve water, then the reduction in flows in drains that discharge directly to the Salton Sea from the IID water service area would be 7 percent. Thus, depending on the amount of water conserved through fallowing, the reduction in flows would be between 7 and 39 percent. This reduction in flow would potentially decrease the amount of habitat for desert pupfish in the IID water service area, which could increase their susceptibility to interspecific competition/interference and predation and result in a smaller overall population size because of reduced physical space.

Individual pupfish are believed to use shoreline pools and the Salton Sea to move among the various drains. Modeling by Reclamation (January 2002) indicates the salinity of the Salton Sea would continue to gradually increase over the next 75 years in the absence of water conservation. As the sea becomes more saline and nears the limit of pupfish tolerance, movement among the drains could cease and isolate populations. Small, isolated populations are more susceptible to problems associated with reduced genetic variability and the impacts of random environmental events. This condition would occur under the baseline and with water conservation; however, water conservation would accelerate the rate of increasing salinity relative to the baseline (Figure 4-4). Pupfish have a high salinity tolerance, and have been recorded at a salinity of 90 ppt. At this salinity, the sea could become intolerable to pupfish and prevent them from moving among drains. Under baseline conditions, the projections show that the mean salinity of the Salton Sea would not exceed 90 ppt in 75 years. Thus, under baseline conditions, pupfish would be expected to be able to continue to use the sea to move among drains. With conservation using on-farm and system-based measures to conserve 300 KAFY, the mean projections show the mean salinity of the Salton Sea exceeding 90 ppt in about 20 years.

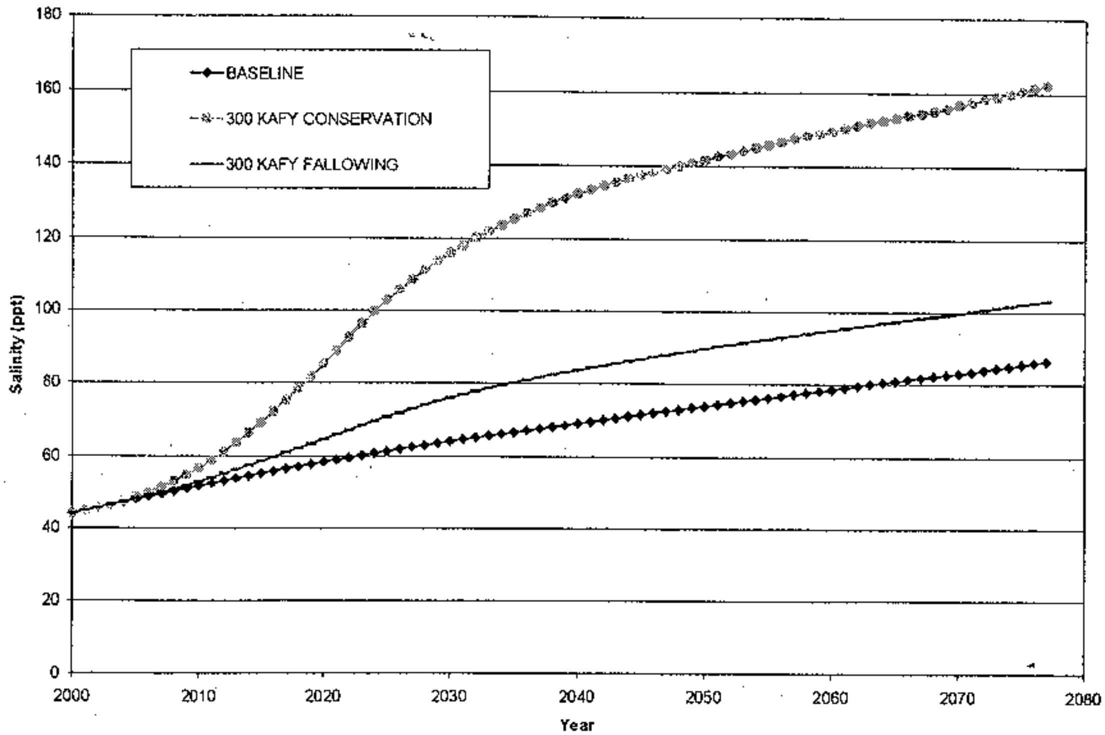


FIGURE 4-4
Projected Salinity Levels With and Without Implementation of the Water Conservation and Transfer Programs

Because water conservation would reduce the contribution of tailwater to the drainage system, water quality conditions in the drains also could worsen. Assuming water conservation using on-farm irrigation-system and water delivery system improvements, IID's water conservation actions would decrease the concentration of pesticides in drainwater (as associated with TSS and sediment-associated contaminants), potentially benefiting the desert pupfish, but concentrations of selenium, salinity, and dissolved constituents in the drains would increase relative to current conditions. If all water was conserved through fallowing, water quality conditions would likely improve. Thus, the magnitude of water quality changes would depend on the amount of water conserved through fallowing. The impacts of elevated selenium concentrations on desert pupfish reproduction and survival have not been directly assessed, and the Service currently is funding a study to evaluate the impacts of selenium on desert pupfish. Other future studies might also evaluate the potential impacts of selenium on desert pupfish and identify important concentration thresholds.

Reclamation will implement Pupfish Conservation Measure 2, as described in Chapter 1. Under Pupfish Conservation Measure 3, Reclamation will contribute funding for routine monitoring of pupfish presence in the drains to confirm continued use and to develop information useful in adaptively adjusting management actions for this species. With implementation of the pupfish conservation measures, existing levels of drain habitat would be maintained, the level of connectivity between drains and the Sea would be maintained, and the potential for adverse impacts on desert pupfish resulting from changes in selenium concentrations would be avoided or minimized.

4.3.2 Razorback Sucker

Razorback suckers inhabit portions of the conveyance system and are known to occur in the All American and East Highline Canal systems. With implementation of water conservation measures by IID, the amount of water in the conveyance system could be reduced by 300 KAF annually. Although the volume of water would be reduced, this reduction would not impact the amount of aquatic habitat in the canal system, because the water surface elevation in the conveyance system is tightly controlled to maximize hydroelectric power generation and efficient delivery of irrigation water. The suckers in the IID water service area are composed of old members of a dwindling, non-reproductive, remnant stock (Tyus, 1991; Minckley et al., 1991). No recruitment of wild-spawned fish occurs, and they are isolated from the main razorback sucker population in the Colorado River and its tributaries.

Water conservation would likely be accomplished through a combination of on-farm and system-based conservation measures. Installation of some water delivery system improvements (e.g., canal lining) would require temporary dewatering of canal sections. While dewatering of canal sections could occur, none of the lateral canals that IID has considered lining to conserve water are known to contain razorback suckers. Therefore, it is extremely unlikely that this action by IID would result in take of razorback sucker.

4.3.3 Yuma Clapper Rail

In the project area, Yuma Clapper Rails predominantly occur on the state and federal refuges. Since 1990, the number of clapper rails counted on the Imperial WA has varied between 90 and 331, and on the Salton Sea NWR, rail numbers have fluctuated between 13 and 102. Combined, the refuges in the area have supported 106 to 411 clapper rails each year. Although comprehensive surveys have not been completed in areas off the refuges, habitat availability is limited off refuges. Consistent with the limited habitat availability off the refuges, the number of clapper rails reported there has been low, ranging from 3 to 43 in surveys conducted between 1990 and 1999. Few of these sightings were in the drains and clapper rails have only been reported in three drains (Holtville Main, Trifolium No. 1, and Bruchard).

Agricultural drains support limited use by clapper rails. High-quality habitat for Yuma Clapper Rails consists of mature stands of dense or moderately dense cattails intersected by water channels. Rails breed, forage, and find cover in this type of habitat. Rails have also been reported using areas of common reed, although nesting is uncertain and density is lower than in cattail marshes. The IID drainage system is estimated to contain about 63 acres of cattails. Common reed, tamarisk, and arrowweed are the predominant species of the remaining 589 acres of vegetation estimated in the drainage system. The vegetation characteristics of the drains suggest the drains provide poor quality habitat for rails. Further, Anderson and Ohmart (1985) found the home ranges of rails to average about 18.5 acres/pair. The drains are unlikely to support a block of vegetation this size, which further suggests that habitat in the drains is of limited quality to rails. A maximum of nine rails have been reported in two drains. Breeding has not been verified in the drains, but rails have been documented in surveys of drains during the breeding season.

Potential impacts from IID's water conservation actions on Yuma Clapper Rails consist of temporary and permanent loss of habitat and exposure to increased selenium concentrations. Changes in flows in drains could alter drain vegetation, impacting the Yuma Clapper Rail. With conservation of 300 KAFY, the reduction in drain flows would be between 9 and 28 percent relative to current conditions, depending on the amount of water conserved through fallowing. Changes in flow in drains would be manifested as a total reduction in flow volume, with potentially shorter durations of peak flows and reduced frequency of peak flows. Periods of dryness likely would increase in frequency and duration, and potentially a greater number of drains would be dry at any given time. Nevertheless, the level of potential flow reduction in the drains is within the historic range of drain flows.

Much of the vegetation in the drainage system is tamarisk and *Phragmites*. These highly invasive species are tolerant of a wide range of conditions. As such, they would adjust to flow changes in the drains, and their occurrence and distribution of species would not change substantially. Cattails and other wetland plants used as habitat by clapper rails are limited. Cattails are concentrated in the bottoms of drains. Because of the steep drain sides, little difference in water depths would occur with lower flow volumes. If drains were drier for longer periods of time, minor, temporary changes in the extent of cattails would potentially occur. However, because drain maintenance activities probably have a greater influence on the extent of vegetation and the projected decrease in drain flows would be within range of historic levels, changes in drain flows would not substantially change the amount or composition of drain habitat for Yuma Clapper Rails.

By increasing the ratio of tilewater to tailwater in the drains, the IID water conservation measures would increase salinity in the drains. Cattails are sensitive to salinity levels. Growth is best when water salinity is less than 3 g/L (3,000 ppm). Salinity levels of 3 to 5 g/L stunt the growth of cattails. Above 5 g/L (5,000 ppm), growth and survival of cattails are limited. The total amount of cattail vegetation (63 acres) could potentially be reduced, as could the amount with good growing conditions. With conservation of 300 KAFY through on-farm and system-based measures, the acreage of cattails supported in the drains would potentially be reduced by 4 acres. An additional 23 acres of remaining cattail vegetation would be subjected to increased salinity levels that could stunt growth and reduce vigor of the plant. If all fallowing is used to conserve water, there would be no change in drain salinity and, therefore, no impacts to cattail vegetation. Use of fallowing to conserve a portion of the 300 KAFY would result in intermediate impacts. The loss or stunting of cattail vegetation in the drains constitutes a potentially significant impact of IID's water conservation actions on Yuma Clapper Rails.

As part of its proposed conservation measures, Reclamation will create 31 acres of high quality managed marsh habitat (Clapper Rail Conservation Measure 1). The created habitat will be of substantially better quality for Yuma clapper rails than drain habitat, because it will contain preferred plant species (i.e. cattails and bulrush), have better water quality, and be configured to provide a mix of dense vegetation interspersed with open water. The created habitat is anticipated to be managed in a similar manner as emergent freshwater marsh units are managed on the refuges.

Rails also could be impacted through exposure to slightly higher concentrations of selenium in the drains as a result of IID's conservation actions. Following the methods described in the Draft HCP for IID's proposed water conservation and transfer program (Appendix C of the Draft EIR/EIS [IID and Reclamation, 2002]), potential impacts of increased selenium concentrations in the drains on clapper rail egg hatchability are predicted for IID's actions. Under current conditions, selenium concentrations result in hatchability impacts in approximately 3 percent of Yuma Clapper Rail clutches. As a result of IID's water conservation actions, hatchability impacts due to selenium could affect up to 6 percent of Yuma Clapper Rail clutches, comprising a 3 percent increase above current conditions.

Under the proposed Conservation Plan, Reclamation will create an additional 42 acres of high quality managed marsh to offset the impacts of increased selenium concentrations on clapper rail egg hatchability (Clapper Rail Conservation Measure 2). This additional acreage of managed marsh is in addition to the 31 acres created under Clapper Rail Conservation Measure 1 and would be phased in over 15 years. The selenium concentration of water used to support the managed marsh is expected to be close to 2 ppb. This selenium concentration is considerably lower than the selenium concentration in most drains in the IID water service area. Adverse impacts from selenium toxicity would be avoided in the managed marsh, and the quality of the managed marsh habitat would be further enhanced beyond that in the drains.

Under the proposed conservation plan, Reclamation will develop a long-term management plan for the created managed marsh habitat. The management plan will include a monitoring plan for the mitigation marshes that specifies performance criteria for vegetation growth and specific monitoring techniques to be used (Clapper Rail Conservation Measure 3).

With implementation of the clapper rail conservation measures, the amount of high-quality clapper rail habitat would be increased (Clapper Rail Conservation Measure 1), and the potential for adverse impacts on clapper rails resulting from increases in selenium concentrations would be mitigated (Clapper Rail Conservation Measure 2). The results of the monitoring carried out under Clapper Rail Conservation Measure 3 are expected to further benefit clapper rails by providing information necessary for Reclamation to manage the created marsh habitat in a manner that insures its suitability as habitat for clapper rails and encourages the continued persistence of clapper rails in the Imperial Valley.

4.3.4 Mountain Plover

The Mountain Plover is a common winter visitor to the Salton Sea Basin. The Imperial Valley has one of the Mountain Plover's largest wintering populations in the Pacific Flyway. During February 1999 surveys, 2,486 individuals were counted in the valley. This number represents about half of the California population and about one-quarter of the North American population.

In the Imperial Valley, Mountain Plover are strongly associated with agricultural fields. Recent studies have found mountain plover to most frequently use grazed alfalfa and burned Bermuda grass fields. They have also been reported to forage in plowed fields and sprouting grain fields during the winter. Depending on water conservation measures implemented, the amount of agricultural land in production could be reduced by up to 15 percent. Currently, over 500,000 acres of agricultural habitat is available within the Imperial Valley for the over-wintering Mountain Plover population. If the maximum acreage of agricultural lands identified in this proposal were taken out of production, approximately 425,000 acres would remain to support the 2,500 individuals in the wintering population. Mountain Plovers are known to congregate in large groups during the winter; the reduction of 15 percent of the available foraging habitat within the Imperial Valley would have no effect on this population.

Installation of water conservation measures in agricultural fields has little potential to impact Mountain Plovers. On-farm conservation measures would be installed when crops were not being grown, primarily in the summer. Mountain Plovers only occur in the project area during the winter and therefore, would not be in the area when this work was being conducted.

4.3.5 Southwestern Willow Flycatcher

Southwestern willow flycatchers consistently occur in the project area during migration. They are not known to breed in the project area, but recent observations of willow flycatchers during the breeding season along the Whitewater River suggest this species could breed in the project area in the future. Willow flycatchers typically are associated with willow thickets. Willow thickets do not exist in the project area, but willow flycatchers have been reported using tamarisk and common reed along the Salton Sea and agricultural drains, and in seepage communities adjacent to the East Highline Canal during migration.

Construction of facilities necessary for various water conservation activities have the potential to permanently impact about 65.5 acres of tamarisk scrub habitat in the Imperial Valley. Of the 65.5 acres potentially permanently lost, 15 acres would be located along the New and/or Alamo Rivers, 43 would be along the East Highline Canal, and 7.5 acres would be in the drainage system. The 65.5 acres of potential permanent loss of tamarisk constitutes less than 1 percent of the quantified acreage of tamarisk scrub in the IID service area. Up to an additional 100 acres of tamarisk scrub habitat could be removed during construction activities along the AAC or other canals adjacent to desert habitat. In addition, a reduction in the water surface elevation of the Salton Sea, resulting from water conservation, could impact up to 2,642 acres of tamarisk scrub habitat adjacent to the Salton Sea. However, it is unknown whether any of this habitat is currently suitable breeding habitat for the Southwestern Willow Flycatcher.

Although the potential for take of Southwestern Willow Flycatchers due to IID's water conservation measures is presently unknown, the lack of documented breeding by the species within the project area suggests that there is little potential for take of this species.

Nevertheless, Reclamation is proposing conservation measures which would minimize even this small potential for take. Reclamation proposes to evaluate all potential cottonwood-willow and tamarisk stands for Southwestern Willow Flycatcher breeding habitat suitability (Conservation Measure 1), and all stands considered suitable will be surveyed during the breeding season (Conservation Measure 2).

If suitable Southwestern Willow Flycatcher breeding habitat is identified during Conservation Measure 1, this habitat will be monitored to quantify changes in the amount and quality of habitat. If suitable breeding habitat is lost or the quality of the habitat declines so that it is no longer considered suitable breeding habitat, this loss will be mitigated through replacement at a 1:1 ratio.

If occupied Southwestern Willow Flycatcher breeding habitat is identified in Conservation Measure 2, this habitat will be monitored to quantify changes in the amount and quality of habitat. If occupied breeding habitat is lost or the quality of habitat declines so that it is no longer considered suitable breeding habitat, this loss will be mitigated through replacement at a 2:1 ratio.

A long-term management plan will be developed for any mitigation habitat acquired or created, including a monitoring plan.

4.3.6 Bald Eagle

A few bald eagles (three or fewer) are regularly observed at the Salton Sea during the winter. Bald Eagles are not known to use drains, and, because of the abundance of fish and waterfowl at the Salton Sea and adjacent refuges, the drains do not provide essential foraging habitat for Bald Eagles. The primary mechanism through which water conservation measures could impact the Bald Eagle at the Salton Sea is a reduction in fish abundance. The abundance of tilapia and other fish is expected to decrease as the salinity of the Sea increases. Water conservation is projected to increase the rate of salinization and accelerate the decline in fish abundance at the Salton Sea. The Imperial Valley and Salton Sea areas are heavily used by wintering and migrating waterfowl. It is likely that as fish prey decline, Bald Eagle predation on avian prey will increase, or individual Bald Eagles will move to another wintering area.

Bald eagles could benefit from the Clapper rail conservation measures. Although fish are the primary prey of bald eagles, they also prey on waterfowl. With implementation of the Clapper rail conservation measures, at least 52 acres of managed marsh habitat would be created. The Imperial Valley and Salton Sea areas are heavily used by wintering and migrating waterfowl. The created marsh habitat would attract migrating and wintering waterfowl. As such, it would provide additional foraging opportunities for bald eagles, overall benefiting the species.

4.3.7 California Brown Pelican

Most use of the Salton Sea is by post-breeding visitors, with more limited use for wintering. These visitors are mostly young birds that disperse northward from breeding areas in the Gulf of California (Hazard, personal communication). Shuford et al. (2000) reported that California Brown Pelicans occur at the Salton Sea primarily from mid-June to early October. They observed the highest numbers in August. The primary wintering area in the United States is along the California coast (Johnsgard, 1993).

In 1996, California Brown Pelicans began nesting at the Salton Sea (Shuford et al., 1999) but have not successfully fledged young. The number of breeding birds has been low, with six pairs nesting in 1996 and several pairs attempting to nest in most years since then (Shuford et al., 1999). California Brown Pelicans did not nest at the sea in 1999 (Shuford et al. 2000), Nesting birds have used tamarisk at the Alamo River Delta and attempted to nest at Obsidian Butte (S. Johnson, personal communication).

The primary mechanism through which IID's water conservation activities could result in take of California Brown Pelicans at the Salton Sea is a reduction in fish abundance. Compared to the No Action condition, water conservation is projected to increase the rate of salinization and accelerate the decline in fish by approximately 11 years, depending on the species.

Based on salinity projections for continuation of existing conditions, salinity would exceed the level at which sargo, gulf croaker, and tilapia could complete their life cycles in 2008, 2015, and 2023, respectively. The salinity threshold above which orangemouth corvina cannot complete their life cycle is about 40 g/L. However, young-of-the-year and juvenile corvina have been captured recently in the Salton Sea, indicating successful reproduction (Riedel et al., 2001). The highest catches of corvina were from the river deltas and nearshore areas, where salinity levels could be lower and within tolerances of corvina. It is uncertain how much longer corvina will reproduce.

Tilapia abundance would likely decline at a salinity greater than 60 g/L. However, relatively freshwater inflow from the New and Alamo Rivers creates an estuarine environment in the river deltas where salinity levels are lower than in the main body of the Salton Sea. Under current conditions, Costa-Pierce and Riedel (2000) reported salinity levels, ranging from 10 to 30 g/L in the river deltas. Tilapia could persist if the deltas provide lower salinity environments.

With the continued persistence of tilapia, pelicans would likely continue to visit the Salton Sea as post-breeders. Because post-breeding pelicans wander over large areas, they would likely remain for a shorter period of time or seek out more favorable foraging areas in the Gulf of California or along the Pacific Coast, if foraging becomes energetically unfavorable at the Salton Sea. These areas are within distances that brown pelicans can travel. As such, whether any take of post-breeding California Brown Pelicans would occur as a result of changes in fish abundance with decreased water delivery to the IID service area, and ultimately to the Salton Sea, is uncertain. Depending on the degree to which the tilapia population declines, California Brown Pelicans may not nest at the Salton Sea in the future and foraging opportunities could be reduced.

First-year California Brown Pelicans are believed the most vulnerable to adverse impacts of reduced prey availability at the Salton Sea, and most California Brown Pelicans there are first-year birds. The number of California Brown Pelicans fluctuates considerably within and among years. For example, Shuford et al. (2000) counted about 300 birds in June 2000, followed by an increase to about 1,000 birds in August. Use subsequently declined to fewer than 50 birds in September. Based on this variability and considering maximum counts of 2,000 and 5,000 birds in previous years, use of the Salton Sea by California Brown Pelicans is assumed to average about 1,000 birds over the 5-month period from June through October.

California Brown Pelicans that have nested at the Salton Sea represent less than 1 percent of the California breeding population (Johnsgard, 1993) and a far smaller percentage of the subspecies' entire population. Because of the small number of birds that have nested at the sea and the infrequency of nesting, the impact associated with the potential loss of future breeding opportunities for California Brown Pelicans would be minor. A reduction in prey availability could adversely impact about 30 percent of the first-year post breeding population of pelicans (i.e., about 300 birds).

Reclamation proposes to minimize the potential take of brown pelicans through three conservation measures. First, in cooperation with the California agencies, Reclamation proposes to fund comprehensive range surveys in order to assist FWS in determining population status of the California Brown Pelican. The scope of the surveys would be developed in cooperation with the FWS CDFG, and recognized pelican experts. Second, Reclamation, in cooperation with the California agencies, proposes a program to inventory existing and former breeding colonies rangewide, and contribute funding to conservation efforts aimed at reducing disturbance of nesting colonies where appropriate. Human disturbance to nesting colonies is a significant threat to colonial seabirds, including the California brown pelican (Velarde and Anderson 1994). The program could include environmental education and monitoring of nesting colonies, which can be effective at increasing breeding success (Velarde and Anderson 1994). Finally, in cooperation with the California agencies, Reclamation would provide funding to establish a conservation fund which could be used for a broad variety of conservation actions to assist in the recovery of the brown pelican. Such actions could include habitat improvement projects, measures to minimize disturbance to nesting colonies, research into the species status and obstacles to recovery, or other actions deemed necessary by FWS and the CDFG. A goal of the conservation fund would be to develop additional data to assist FWS and CDFG to better determine the precise status of the species and to assist in their recovery. Reclamation believes there are opportunities to build upon existing efforts and programs by providing additional resources from the fund.

The impact of these actions would be to improve knowledge about the status of the species and its needs, provide funding to meet those needs, increase breeding success, increase colony size, and potentially contribute to the re-establishment of former colonies.

CHAPTER 5

Conclusions and Determinations

5.1 Desert Pupfish

Water conservation measures undertaken by IID would accelerate the rate of change in salinity in the Salton Sea, impacting desert pupfish through reduced connectivity between populations in the future. Decreased flows in the drains have the potential to impact desert pupfish through a reduction in physical habitat. Increased selenium concentrations in drains inhabited by desert pupfish have the potential to adversely impact desert pupfish. Reclamation has determined the cumulative effects of IID's water conservation measures may affect, and are likely to adversely affect the desert pupfish. The Conservation Plan proposed by Reclamation will avoid and minimize the potential for take of desert pupfish.

5.2 Razorback Sucker

As a result of IID's water conservation measures, some water delivery system improvements (e.g., canal lining) could occur, requiring temporary dewatering of some canal sections. None of the lateral canals that IID has considered lining to conserve water are known to contain razorback suckers; therefore, incidental take of individual suckers is unlikely to occur. Because razorback sucker in the canal system are isolated from the populations in the LCR and are not reproducing, and take is not expected to occur, Reclamation has determined that its proposed Conservation Plan, including cumulative effects from IID's water conservation measures, would have no effect on razorback sucker in the project area.

5.3 Yuma Clapper Rail

Potential cumulative effects from IID's water conservation measures on clapper rails consist of temporary and permanent loss of habitat and exposure to increased selenium concentrations. Because drain maintenance activities probably have a greater influence on the extent of vegetation in the drains and the projected decrease in drain flows would be within the range of historic levels, changes in drain flows would not substantially change the amount or composition of drain habitat for Yuma Clapper Rails. With conservation of 300 KAFY by IID through on-farm and system-based measures, the acreage of cattails supported in the drains would potentially be reduced by 4 acres. Most of the remaining cattail vegetation would be subjected to higher salinity levels that could stunt growth and reduce vigor of the plant. Yuma Clapper Rails also could be impacted through exposure to slightly higher concentrations of selenium in the drains, which could reduce Yuma Clapper Rail egg hatchability by 3 percent compared to existing conditions. Reclamation has determined that the cumulative effects from IID's water conservation actions may affect, and are likely to adversely affect the Yuma clapper rail through loss or stunting of cattail vegetation in the drains and reduced egg hatchability. The Conservation Plan proposed by Reclamation will avoid and minimize the potential for take of Yuma clapper rail.

5.4 Mountain Plover

In the Imperial Valley, Mountain Plover are strongly associated with agricultural fields. Depending on the water conservation measures implemented by IID, the amount of agricultural land in production could be reduced by up to 15 percent. Even with a reduction of 15 percent, approximately 425,000 acres of agricultural lands would remain. The remaining agricultural lands would provide ample foraging habitat for the current population of 2,500 wintering plovers. Any construction associated with implementing water conservation measures would be conducted during time periods when Mountain Plover are not likely to be present. Reclamation has determined that its proposed Conservation Plan, including cumulative effects from IID's water conservation actions, would have no effect on Mountain Plover.

5.5 Southwestern Willow Flycatcher

Willow flycatchers consistently occur in the project area during migration, but are not known to breed in the project area. Southwestern Willow Flycatchers typically are associated with willow thickets, which do not exist in the project area. However, willow flycatchers have been reported using tamarisk and common reed along the Salton Sea and agricultural drains, and in seepage communities adjacent to the East Highline Canal during migration. Construction of facilities necessary for various water conservation activities have the potential to permanently impact about 65.5 acres of tamarisk scrub habitat in the Imperial Valley. Given the low level of migratory use of the project area by Southwestern Willow Flycatchers, the low quality of tamarisk as habitat for this species, the abundance of potential habitat in and around the project area, and no reported observations of Southwestern Willow Flycatcher breeding, Reclamation has determined that its proposed Conservation Plan, including cumulative effects from IID's water conservation measures, may affect, but is not likely to adversely affect, the Southwestern Willow Flycatcher.

5.6 Bald Eagle

A small population of bald eagles is regularly observed at the Salton Sea over the winter. Water conservation measures undertaken by IID are expected to increase the rate of salinization of the Sea and accelerate the decline in fish abundance at the Salton Sea. If foraging opportunities became limited because of reductions in fish availability at the Salton Sea, Bald Eagles would likely increase predation on avian prey or over-winter in other areas. Reclamation has determined that its proposed Conservation Plan, including cumulative effects from IID's water conservation actions, would have no effect on the Bald Eagle.

5.7 California Brown Pelican

Most use of the Salton Sea is by post-breeding visitors, with more limited use for wintering. California Brown Pelicans only recently started nesting at the Salton Sea and have not successfully fledged young. The primary mechanism through which IID's water conservation activities could take California Brown Pelicans at the Salton Sea is a reduction in fish abundance. The abundance of tilapia and other fish is expected to decrease as the salinity of sea increases. Water conservation is projected to increase the rate of salinization of the sea and accelerate the decline in fish abundance by approximately 11 years, depending on the species. If foraging becomes energetically unfavorable at the Salton Sea, post-breeding pelicans will likely seek more favorable foraging areas elsewhere. California Brown Pelicans that have nested at the Salton Sea represent less than 1 percent of the California breeding population and a small percentage of the subspecies' entire population. Reclamation has determined that the cumulative effects from IID's water conservation actions may affect, and are likely to adversely affect, the California Brown Pelican. The Conservation Plan proposed by Reclamation will avoid and minimize the potential for take of California Brown Pelican.

CHAPTER 6

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